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United States Government | Department of Energ

memorandum

DATE: DEC 1 1996

REPLY TO ATTN OF: Tim Fox:EH-71:3-7035

SUBJECT: TECHNICAL LETTER OF DIRECTION #97-ES-0007046 REVISION 0, FOR THE UNIVERSITY OF UTAH

TO:

James M. Turner, Manager
Oakland Operations Office

This Technical Letter of Direction authorizes the Oakland Operations Office to negotiate, award, and obligate funds for a cooperative agreement to perform the attached work set forth in the University of Utah's unsolicited proposal #9612057 entitled "Dosimetry Studies in Support of EH-63 Programs." Funding for this activity was provided in the January FY 1997 Approved Financial Plan.

The applicable financial data is as follows:

Funding:	$615,000
Budget & Reporting Number:	HD2006300
Appropriation:	89X0243.91
Allotment:	CR-73-91
Financial Plan/Fund Type:	EN/TF

Should you have any questions regarding this matter, please contact Lesley Gasperow on (301) 903-5577 or have your staff contact Tim Fox on (301) 903-7035.

for Paul J. Seligman, M.D., M.P.H.
Deputy Assistant Secretary
for Health Studies

Lesley Gasperow, Director
Office of Budget and Administration

Attachments:
1. Unsolicited Proposal
2. Justification for Non-Competitive Financial Assistance
3. Technical Evaluation of Cost Proposal

cc w/attachments:
Joan Macrusky, OAK
Larry Marteil, OAK
Geoffrey Judge, EH-7

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Joe B.

THE UNIVERSITY OF UTAH

HANDLED BY P.I.

17 December 1996

Ms. Elizabeth P. White
U.S. Department of Energy
Office of International
Health Programs
EH-63/270CC
19901 Germantown, MD 20874-1290

SUBJECT: Proposal/Application
UofU P.I.D. #: 9612057

Enclosed are the original and three (3) copies of the subject document for the project entitled, **"Dosimetry studies in support of EH-63 programs"**, under the direction of *Dr. Scott Miller*, Department of Radiobiology.

Please send notice of funding status to the **Office of Sponsored Projects, 1471 Federal Way, Salt Lake City, UT 84102.**

Sincerely,

Amy J. Hofheins, Manager
Sponsored Projects
301-585-6946 (OFFICE)
301-585-3300 (FAX)

jn

Enclosures

cc: Dr. Scott Miller

Office of Sponsored Projects
1471 Federal Way
Salt Lake City, Utah 84102
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Work Proposal

DOSIMETRY STUDIES IN SUPPORT OF EH-63 PROGRAMS

Submitted to the
Office of International Health Programs (EH-63)
U.S. Department of Energy (DOE)

Scott Miller
Project Director

Division of Radiobiology
University of Utah

SPECIFIC AIMS:

To support the Department of Energy to perform various dosimetric and related projects critical to studies being conducted on the effects of radiation on those exposed to the Hiroshima and Nagasaki atomic bombs, the Chernobyl accident, and radioactive contamination from the Mayak facility. Specific tasks to be carried out by the University of Utah include:

1) Hiroshima Neutron Dosimetry,
2) Iodine-129 Dosimetry,
3) Retrospective Dosimetry Using Electron Paramagnetic Resonance and Thermoluminescence Techniques in Contaminated Areas of the Former Soviet Union.
4) Dosimetry and Risk Assessment as Related to Cohorts Exposed to the Radioactive Contamination from the Mayak Facility, and
5) Dosimetry Research and Risk Analysis in the Ukraine and Belarus of Those Affected by the Chernobyl Accident:

1. Hiroshima Neutron Dosimetry

The University of Utah will resolve the neutron discrepancy in the Hiroshima dosimetry system developed in 1986 (DS86) by performing neutron activation measurements on samples collected at various distances from the hypocenters of Hiroshima and Nagasaki. The principal investigator will accomplish this task by:

a) Performing test measurements using copper wire exposed to neutrons at the National Institute of Standards and Technology (NIST), Gaithersburg, MD.;
b) Obtaining copper wire samples from Hiroshima and Nagasaki and measuring them for nickel-63 in order to obtain fast neutron fluences: and
c) Measuring and profiling the thermal neutron activation of Chlorine-36 in concrete cores from near the Hiroshima hypocenter to beyond 2000 meters and comparing measurements with calculations based on DS86, in order to complete the evaluation of thermal neutron fluences as a function of distance from the hypocenter at Hiroshima.

2. I-129 Dosimetry

The University of Utah will work with collaborators in Munich and Minsk to develop a map of iodine for Belarus that includes both total iodine concentrations in soil and radioiodine deposition densities. The principal investigator will accomplish this task by:

a) Developing a sampling protocol agreed to by Belarus, Germany, and the United States;
b) Completing the collection of soil samples from selected political jurisdictions of Belarus;
c) Providing training at the University of Utah for a Minsk chemist on how to extract iodine from soil samples;
d) Providing equipment for the Minsk laboratory so that they can reliably extract iodine from soil;
e) Extracting iodine from the soil samples collected during the 1997 Belarus soil sampling expedition (to be carried out predominantly in Minsk, with some quality assurance on selected samples at the University of Utah);
f) Measuring total iodine in most of the samples and iodine-129 in some of the samples; and
g) Publishing papers in peer-reviewed journals on the iodine work.

3. *Retrospective Dosimetry Using Electron Paramagnetic Resonance (EPR) and Thermoluminescence (TL) Techniques in Contaminated Areas of the Former Soviet Union*

The University of Utah will collaborate with the European Community (EC), the Ukrainian Scientific Center for Radiation Medicine (USCRM), the Urals Research Center for Radiation Medicine (URCRM), and the Urals Institute of Metal Physics to conduct retrospective dosimetry using EPR and TL techniques. (Separate agreements will be developed with each organization with which the University of Utah is collaborating and will be provided as an attachment to this package.)

a) Collaboration with the EC:

The purpose of this task is to participate in collaborative studies with laboratories throughout western Europe to assess the feasibility of solid state and biological methods for retrospective dosimetry as well as modeling efforts which may be applied to accident sites in the Former Soviet Union (FSU). This task will involve:

1) Participating in EPR group of the EC to select, prepare, and analyze 10 teeth, in order to determine the uncertainties associated with different methods of preparation and analysis of enamel samples; and
2) Participating in the TL group of the EC project to intercalibrate and intercompare 10 brick, tile, and porcelain insulator samples taken from contaminated regions in the FSU.

b) Collaboration with the USCRM:

This task will involve working with the USCRM to:

1)Partner with USCRM to cross-train with their scientists in methods for TL sample preparation and analysis in both American and Ukrainian facilities.

c) Collaboration with the URCRM:

This task will involve working with the URCRM to:

1) Train their scientists on techniques for sample preparation and TL analysis; and
2) Collect samples and conduct background dosimetry and analysis.

d) Collaboration with the Urals Institute of Metal Physics:

This task will involve working with the Urals Institute of Metal Physics to:

1) Perform replicate analysis on a set of teeth for which more than one tooth has been removed from an individual during the course of routine dental extraction; and
2) Perform an intercomparison and intercalibration.

13. RMI wants more data on the thyroid experiments done at the Cleveland Clinic.

    o This is an issue that would have to be opened with Department approval and funding to see if such records still exist.

14. RMI is concerned there is too much medical monitoring and not enough medical care

    o Full medical treatment of the Rongelap and Utirik exposed population of 137 individuals is provided for any medical conditions that have the potential to be radiogenic in origin. This is consistent with Congressional direction in Public Law 99-239, "The Compact of Free Association".

    o If the Department were to be responsive to this, Congress would have to amend the law to direct this change or direct that the program provide full medical coverage and provide more funding to make such expanded care possible. Staff at Brookhaven would have to be augmented and perhaps a permanent physician stationed in the Marshall Islands to ensure year around medical coverage.

15. RMI feels the U.S. Government and DOE are not interested in the welfare of the Marshall Islanders

    o The degree to which the United States agrees to provide medical coverage to the Marshallese people is a decision that must be made and funded by Congress.

    o The Department has had a long association with the exposed and comparison populations and has devoted its program and its dedicated staff efforts to ensuring the well-being and the best medical care that can be provided in the Marshall Islands. When that is not enough for those with suspected radiogenic conditions, the Department sends and funds the patient by referral

possibility of surface contamination or resurfacing of the building after the war, the first slice is not used to determine bomb-induced ^{36}Cl activation. Rather, the second or third slice, whichever is visually identified to be part of the actual reinforced concrete wall, is used for that purpose. The concrete slices are then ground to >400 mesh, leached in 50- to 100-g batches with deionized water (DIW) to remove possible chlorine contaminants (1:5, weight sample per weight DIW), and both fractions saved for chloride processing and AMS analysis.

The leachate is filtered using a 0.22-μm cellulose-acetate filter, the filtrate treated with .2 ml of 5% barium nitrate ($Ba(NO_3)_2$) to remove sulfates, and then acidified with 1 ml of 70% nitric acid (HNO_3) per 100-ml filtrate. To this solution, 1 ml of 5% silver nitrate ($AgNO_3$) is added and the silver chloride (AgCl) precipitate collected by centrifugation and washed twice in DIW. Further purification of the AgCl is accomplished by dissolving in 2 ml of 15 N ammonium hydroxide (NH_4OH) and reprecipitating by adding HNO_3, as above. The AgCl sample is then collected and dried.

Following sample preparation, approximately 3 to 5 mg of AgCl are loaded into sample holders and $^{36}Cl/Cl$ ratios measured using the LLNL accelerator mass spectrometer. The AMS measurements are made at the Center for Accelerator Mass Spectrometry (CAMS), Lawrence Livermore National Laboratory. The CAMS machine has a typical detection limit of about one atom of ^{36}Cl per 10^{15} atoms of Cl (13). The measured $^{36}Cl/Cl$ ratios are normalized with respect to standards from the National Institute of Standards and Technology. Analytical precision of ~3 to 5% are typical for ^{36}Cl using AMS.

We will use this method to measure thermal neutron activation via ^{36}Cl depth profiles in concrete cores from near the hypocenter to ~3000 m in Hiroshima and to ~2500 m in Nagasaki and compare measurements with calculations based on DS86. These measurements will complete the ^{36}Cl vs distance profiles for Hiroshima and Nagasaki as well as verify the background of the ^{36}Cl activation method in these cities. Japanese collaborators (with funding from Japan) would do the same for their ^{152}Eu methods. We will also perform intercomparison measurements between ^{36}Cl measured at LLNL and ^{152}Eu measured by Japanese investigators to quantify and reduce variations observed between the methods. These intercomparison measurements will be made using aliquots from the same processed samples to reduce variations due to sample differences. The intercomparisons will be done on two samples, one heavily exposed concrete core from near the hypocenter in Hiroshima and another from about 1.5 km, which approaches the detection limits of the measurements techniques.

To compare adequately measured ^{36}Cl activation with DS86 predictions, activation in the Hiroshima and Nagasaki samples will be calculated using the DS86 methodology and data. The computational methods and neutron cross-sections have been described in Straume et al. 1994. Briefly, adjoint Monte Carlo calculations are made starting with the thermal neutron at the capture point and transporting the neutron in reverse time until it escapes the concrete wall. Since the DS86 free-field fluences define the distribution of neutrons incident on the structure, convolution of the free-field neutrons with the adjoint neutrons accounts for the structural shielding. This method makes possible a calculation of the shielding effect at the sample site so that results for samples having various elemental compositions and shielding geometries can be properly compared.

IV. Suggested Performance Indicators: FY97

-Completion of the evaluation of the Munich AMS machine for possible use in long distance (>1000 m) ^{36}Cl measurements in Hiroshima (April 1997).

-Completion of the ^{63}Ni test measurements and submission of a paper for publication in a peer-reviewed journal (June 1997).

-Completion of the measurement of ^{36}Cl in concrete cores from Hiroshima. The products will be (1) a full-range thermal neutron activation profile in "free air" from near the hypocenter to more than 2000 m in Hiroshima, and (2) submission of a peer-reviewed publication (September 1997).

V. References

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Shizuma, K., Iwatani, K., Hasai, H., Hoshi, M., Oka, T., Morishima, H. Residual Eu and Co activities induced by neutrons from the Hiroshima atomic bomb. *Health Phys.* **65**, 272-282 (1993).

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best-candidate reaction appears to be $^{63}Cu(n,p)^{63}Ni$. The half life of ^{63}Ni is 100 years and the neutron cross section of ^{63}Cu has a threshold of about 1 MeV. Furthermore, samples of copper are available in Hiroshima and more should be obtained now that a careful search is undertaken.

Our calculations indicate that in 1996, the amount of bomb-induced ^{63}Ni present in a copper sample from near the Hiroshima hypocenter would be about 1.5×10^7 atoms g^{-1} for DS86 neutrons. During the past year we have demonstrated that accelerator mass spectrometry (AMS) can be used to measure such a low concentration level. This was achieved by the development of a method for ultra-pure separation of Ni from copper samples. This method involves first an electrochemistry step that reduces the copper impurity by about 6 orders of magnitude followed by a nickel-carbonyl reaction. The "nickel-carbonyl" reaction relies on the reaction of nickel with carbon monoxide to form the volatile compound nickel tetracarbonyl. This reaction is highly specific to nickel and reduces the remaining copper impurity by an additional 8 orders of magnitude. Following nickel carbonyl generation, the sample is thermally decomposed directly in the AMS target holder. During AMS analysis, the ions are identified using characteristic projectile x-rays which allows further rejection of remaining ^{63}Cu.

The present AMS capability at LLNL permits the measurement of Ni induced by Hiroshima neutrons to about 400 m from the hypocenter. This is sufficient to validate (or invalidate) the 1945 sulfur measurements and is critical to the solution of the neutron problem. Importantly, within the past month, new AMS measurements of ^{59}Ni at Munich indicate that it may be possible to improve the detection sensitivity of ^{63}Ni by a factor of 100 using a gas filled magnet. This would be a very important advance in the Hiroshima neutron dosimetry because it would make possible direct measurement of fast neutron activation (and thus fluence) at all distances relevant to A-bomb survivors, i.e., to more than 1500 m from the hypocenter. During the next two months, we will explore this possibility and perform a test measurement on the Munich machine. If the Munich machine is adequate then we will have to provide DOE with a revised budget to include the Munich and related costs. If Munich is not adequate, then we will upgrade the LLNL machine by adding a gas-filled magnet. This can be completed during FY97 as long as $400 K is available for the mods during the first quarter of FY97 (see budget justification).

Measure Thermal Neutron Activation

Our measurement of thermal (low-energy) neutron activation will employ a long-lived isotope of chlorine, ^{36}Cl (half life, 300,000 yr). Chlorine-36 is produced when a thermal neutron is captured by stable ^{35}Cl. The typical samples from Hiroshima and Nagasaki measured for ^{36}Cl are concrete cores obtained from reinforced concrete buildings known to have been present at the time of the atomic bomb explosions in 1945. Cores (10-cm diameter, ~30-cm long) are obtained from walls in line-of-sight with the bomb explosion, and also from shielded parts of the same buildings. The in-line-of-sight cores are used to measure the bomb-induced ^{36}Cl and the shielded cores are used to measure the pre-bomb ^{36}Cl levels in the same or similar concrete. Natural background levels of ^{36}Cl in Hiroshima and Nagasaki concretes will also be measured in samples collected more than 2500 m from the hypocenters.

The elemental composition of each core is determined. Major elements, except oxygen, carbon, and hydrogen, are determined by inductively-coupled plasma atomic emission spectroscopy (ICP-AES). Carbon and hydrogen are determined by combustion analysis. Oxygen is determined by mass-balance analysis, and trace elements are determined by ICP-mass spectrometry.

The concrete cores are cut into approximately 3-cm-thick slices. The first slice contain the surface stucco-like material on the outside of the wall, and, because of the

Project Details

1. Hiroshima Neutron Dosimetry (Principal Investigator: Tore Straume)

I. Goal

The goal of the Hiroshima Neutron Dosimetry project is to resolve the very large neutron discrepancy in the Hiroshima DS86 dosimetry system by performing neutron activation measurements on samples collected at various distances from the hypocenters of Hiroshima and Nagasaki. This is believed to be the only way to confidently resolve this problem.

II. Background

The purpose of this work is to help resolve the large neutron discrepancies in the DS86 dosimetry system for Hiroshima survivors. The present neutron discrepancy is so large (factors of 10 at relevant distances) that if left unresolved will render the most important human radiation data unreliable.

The Hiroshima and Nagasaki atomic bomb survivor data serve as the principal basis for the estimation of radiation induced cancer risk. The risk is calculated from the effect, i.e., the cancer incidence divided by the dose. In turn, these risk estimates serve as the basis for legally binding documents such as Federal radiation-protection standards and guides. Thus, significant discrepancies in the atomic bomb survivor data in either the effects or the dose would cast a shadow of uncertainty over all radiation-protection standards, including those used by DOE. About $40 M per year is going into the epidemiology (i.e., effects) with almost no support for the dosimetry. The radiation risk coefficient will never be correct, no matter how much money is put into the epidemiology, if the doses are not correct. We now know how to solve the dose discrepancy issue; the only thing limiting resolution of the problem is funding that amounts to only a couple of percent of the RERF budget.

This project is a key part of a larger coordinated effort to support the National Academy of Sciences dosimetry evaluation effort for Hiroshima and Nagasaki atomic bomb survivors. The NAS-RERF Dosimetry Committee cannot proceed to solve the serious discrepancy in the DS86 dosimetry system for Hiroshima until we have completed the neutron measurements proposed in this project. The work is overseen by the NAS-RERF Dosimetry Committee (Chairman, Dr. Warren Sinclair). Although DOE/EH has responsibility for supporting RERF studies, including the dosimetry, in prior years this effort was jointly funded by DNA and DOE/EH.

Importantly, the budget proposed here for the Hiroshima Neutron Dosimetry project is dependent on partial support from the Army Office of the Surgeon General (Maj. Curling) for FY97 (150K) and also for FY98 (184K).

III. Methods and Approach

The methods used in this project are described in detail in Straume et al. 1992, 1994, and 1996. In summary, during FY97 we will:

Measure Fast Neutron Activation

During prior FY's, we performed an extensive search for activation reactions with neutron-energy thresholds in the 1-MeV range and with products that have half lives sufficiently long to be measurable today, more than 50 years after the bombings. Only a handful of reactions were identified that could potentially be used in Hiroshima, and the

Straume. T.. Harris. L.J.. Marchetti. A.A., Egbert. S.D. Neutrons confirmed in Nagasaki and at the Army Pulsed Radiation Facility: Implications for Hiroshima. *Radiat. Res.* **138.** 193-200 (1994).

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2. *I-129 Dosimetry (Principal Investigator: Tore Straume)*

I. Goals

During FY97, the goals of this project are to provide training for Minsk chemist to extract iodine from soil samples, help Minsk set-up iodine extraction lab, obtain soil samples from selected Raions of Belarus, measure iodine ^{129}I and provide QA for the Minsk iodine extraction lab. This work will be done together with collaborators in Germany (Munich) and Belarus (Minsk), and in combination will result in a map of iodine for the country of Belarus that includes both total iodine concentrations in soil and radioiodine deposition densities.

II. Background

The purpose of this project is to use methods and capabilities developed during the past several years at LLNL to produce a iodine map for Belarus. The capabilities at LLNL make possible reliable measurement of total iodine concentrations in soil as well as the deposition densities of ^{131}I via the long-lived ^{129}I. We have demonstrated that the ^{129}I isotope can be used as a surrogate for the short-lived ^{131}I released from Chernobyl and thereby substantially reduce uncertainties in thyroid dose estimates in regions where ^{131}I measurements were inadequate. Furthermore, the measurement of total iodine concentrations in selected Raions of Belarus will provide a map that can be correlated with health information related to thyroid disease generally. It is important to note that some regions of Belarus and Ukraine appear to be unusually low in total iodine concentration and could therefore potentially have influenced both thyroid dosimetry and disease.

Radioiodine released to the atmosphere from the accident at the Chernobyl nuclear power station in the spring of 1986 resulted in large-scale thyroid-gland exposure of populations in Ukraine, Belarus, and Russia. Because of the short half life of ^{131}I (8.04 d), adequate data on the intensities and patterns of iodine deposition were not collected. Fortunately, a three-year feasibility study completed in FY95 (that study was supported by the LLNL-LDRD Program) has demonstrated that contemporary measurements of the long lived ^{129}I isotope (half life 16 x 10^6 y) can be used to reconstruct initial ^{131}I deposition. This important finding makes possible the use of contemporary ^{129}I measurements to substantially reduce uncertainties in the thyroid dosimetry supporting childhood-thyroid cancer studies in the region. It was hoped that the deposition density of ^{137}Cs might be a useful surrogate for the deposition density of ^{131}I and that this information, coupled with the use of ecological models, could be used to infer doses to the thyroid. However, our findings from the feasibility study show that ratios of ^{131}I-to-^{137}Cs vary by factors of 20 over space and region indicating that ^{137}Cs is not a reliable surrogate for ^{131}I. It is indeed significant that the region with the second highest number of childhood-thyroid cancer cases in Belarus is not particularly contaminated with ^{137}Cs. This region is a good example of the need for contemporary ^{129}I measurements, because ^{131}I was not adequately measured and the thyroid cancer rates do not correlate with ^{137}Cs contamination levels.

III. Methods and Approach

In cooperation with scientists from Minsk and Munich, we will complete the collection of soil samples from the selected Raions of the country of Belarus. A number of samples have already been collected by LLNL and Munich. LLNL collected 230 core samples from eleven settlements in Belarus during a 1993 expedition, and GSF have an even larger number of soil samples from 1994 and 1995 expeditions (most of the GSF samples have not yet been analyzed). Additional soil samples will be collected in selected regions during the early spring of 1997 immediately after the snow has melted and soil conditions are appropriate. The sampling methods will be according to our prior protocol used in 1993 (see Straume et al., Health Physics, November, 1996).

Soil processing for the extraction of iodine will be done at the Research Institute of Radiation Medicine in Minsk. This involves air drying the samples, sieving, and extraction of iodine using methods that the Minsk scientists will learn at LLNL.

A quality assurance program will be instituted for extraction and analysis to make sure that the extraction and measurement of iodine are correct. This will be done by including coded standards with the samples.

The measurement of ^{129}I will be done jointly by LLNL and GSF using AMS. Also, intercomparisons of ^{129}I will be made between LLNL and GSF to insure comparable results for the same samples. Total iodine measurements using GC will be made in on selected samples in Minsk, LLNL, and GSF for intercalibration and confirmation that the three labs obtain consistent results.

IV. Suggested Performance Indicators, FY97

1) Complete a sampling protocol agreed to by Belarus, Germany, and the United States (April 1997);
2) Provide training at the University of Utah for a Minsk chemist on how to extract iodine from soil samples (May 1997).
3) Complete the collection of soil samples from selected political jurisdictions of Belarus (July 1997); and

V. References

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3. *Retrospective Dosimetry Using Electron Paramagnetic Resonance (EPR) and Thermoluminescence (TL) Techniques in Contaminated Areas of the Former Soviet Union (Principal Investigator: Edwin Haskell)*

I) Summary of Project proposal

Collaboration with Dosimetry Efforts of the European Community.

The University of Utah has been invited to participate in a collaborative dosimetry project under Framework IV (FIV) of the European Union (EU). The project involves laboratories throughout Western Europe and will include laboratories in the Former Soviet Union (FSU) under a complementary program known as Copernicus. The purpose of these programs is to assess the feasibility of solid state and biological methods for retrospective dosimetry as well as modeling efforts which may be applied to accident sites in the FSU. The projects are built on two previous programs with which we have been involved, most recently ECP-10, another EU funded project, and an IAEA Cooperative Research Program originally established through our initiative.

The invitation to join the FIV program offers the opportunity of full participation and significant input into the design and implementation of the research program. Funding is severely limited for all participants of the program, however, funds for travel to all workshops and contractors' meetings are being offered for our participation.

The collaboration of our laboratory with others throughout Europe and the FSU involved in retrospective dosimetry represents an opportunity to leverage limited research funds and to pool the scientific expertise and analytical capabilities of established laboratories with those which are just entering the field. The inclusion of startup laboratories into the collaborative effort insures that the quality of research and routine dosimetric measurements which they will ultimately produce will conform to protocols and guidelines to be established through the FIV and Copernicus efforts. This quality assurance will also be in the interests of ongoing bilateral epidemiological studies between the U.S. and FSU.

The scope of the FIV program for TL and EPR is extensive and will require additional support if we are to participate effectively. Appendix I is an outline of the current protocol for determination of preparation effects associated with EPR analysis of tooth enamel which was developed with our input at the first contractors meeting in May. This study alone will require approximately 1 year for completion and is only one of many envisioned for the project.

Collaboration with Ukrainian Scientific Center for Radiation Medicine (USCRM).

We have worked very closely with Drs. Chumak and Sholom of the USCRM over the past several years. Both investigators visited our laboratory for research purposes, Drs. Chumak and Sholom in September of 1995 for a two week period, and Dr. Sholom again in April of this year for a period of two months. The USCRM is initiating TL measurements on ceramics and porcelain insulators taken from the contaminated areas of the Ukraine. The USCRM has little previous experience with TL analysis and we feel that it is important to provide training and oversight for these measurements. We propose bilateral training visits between our two laboratories and replicate measurements on actual field samples as well as intercomparisons on blind irradiated samples in a manner similar to that performed on irradiated enamel.

Collaboration with the Urals Research Center for Radiation Medicine (URCRM)

Nikolai Bougrov of the URCRM will visit our laboratory for a period of two months during FY-97 for training in the techniques of TL preparation and analysis. His laboratory in the Urals is not yet established, however once equipped it will be involved in routine measurement of ceramic and porcelain samples removed from the contaminated regions of the Urals. We propose close cooperation during the training phase and during the establishment of the analytical capabilities of his laboratory. Again intercomparisons with artificially irradiated samples and with actual field samples are proposed.

Collaboration with the Urals Institute of Metal Physics.

Dr. Alex Romanyukha has spent considerable time in the EPR laboratory of Dr. Albrecht Wieser at GSF in Germany and is developing considerable expertise in EPR analysis of enamel. We have collaborated with Dr. Romanyukha and Dr. Wieser on development of methodology for EPR analysis of internal emitters using differential measurements of dentine in addition to enamel, and we propose continued collaboration on methodology and analysis of enamel samples collected from individuals in the exposed regions of the Urals. We propose joint measurement of intercomparison samples as well as replicate measurement of a certain number of actual field samples once EPR capabilities are established at Dr. Romanyukha's institute. Joint visits are also planned, however the visit of Dr.Romanyukha to the University of Utah is contingent on establishment of a separate funding agreement between the DOE and the URCRM.

II) Summary of work to be done during this period.

Collaboration with Dosimetry Efforts of the European Community.

1) Participation in EPR group of the FIV project will involve selection, preparation and analysis of 10 teeth. The purpose of this study is to determine the uncertainties associated with different methods of preparation and analysis of enamel samples.

2) Participation in the TL group of the FIV project will involve intercalibration and intercomparison of approximately 10 brick, tile and porcelain insulator samples taken from contaminated regions in the FSU. A set of bricks from Zabone, a contaminated settlement in Russia has been collected, and will be analyzed for comparative purposes. Samples will also be analyzed from the Ukraine as well as the Urals region of Russia. EH will participate in two contractors meeting in Germany with travel funds provided by the European Union project FIV.

Collaboration with Ukrainian Scientific Center for Radiation Medicine (USCRM).

2) TL analyses will be performed initially in our laboratory by Dr. Sholom on a scientific visit to our laboratory. The visit will involve training in methods for sample preparation and analysis. Dose depth profiles will be obtained for brick, tile and porcelain insulators. Dr. Sholom will also be trained on our remote control and analysis capabilities accessible from the Ukraine via the internet to our laboratory equipment. Their equipment is best suited for personnel dosimetry with commercial TLDs, however the group has had some success in analysis of quartz from brick and tile.

Collaboration with the Urals Research Center for Radiation Medicine (URCRM)

1) Nikolai Bougrov will visit our laboratory for training in techniques for sample preparation and TL analysis. During this visit samples from the Chelyabinsk region will be prepared and analyzed. The initial analyses performed on these samples will be useful in characterizing the TL from samples from the region and will provide preliminary measurements on dose from selected structures. Other samples from the same structures have been analyzed by Dr. Y. Goksu at GSF and a joint paper will result from comparison of our analyses performed with the quartz inclusion method with her analyses performed with the fine grain technique. Additional samples will be sent to our laboratory as they are collected for analysis. A trip to the URCRM is planned for additional sample collection, background dosimetry and analysis on URCRM equipment once it is obtained and in operation.

Collaboration with the Urals Institute of Metal Physics.

1) Many teeth have been collected in the Urals region under the initiative of Dr. Romanyuhka. Some of these have been analyzed at GSF in collaboration with Dr. Wieser. We will perform replicate analysis on a set of teeth for which more than one tooth has been removed from an individual during the course of routine dental extraction. These analysis will be performed in our laboratory by Dr. Romanyuhka during a two month visit. Once the laboratory of Dr. Romanyuhka is operational we will visit the facility and assist with replicate measurements on his equipment. We will perform a blind intercomparison and intercalibration once the laboratory is operational.

III. Suggested Performance Indicators

-Publication of results of TL intercomparison on Chelyabinsk samples.
-Report on intercalibration of USCRM TL source.
-Report on EU EPR results of sample preparation study.
-Report on collection and anaysis of Russian and Ukrainian TL samples.

IV) References (Literature)--Relationship to Other Projects

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4. *Dosimetry and Risk Assessment as Related to Cohorts Exposed to the Radioactive Contamination from Mayak Facility (Principal Investigator: Lynn Anspaugh)*

I. Concise Statement of Goals

Acting in collaboration with our colleagues at institutes in Russia and the United States, we will

- Develop a modified proposal for work to be done for Project 1.1, "Dose Reconstruction for the Urals Population."
- Develop a proposal for work to be done for Project 2.4, "Improved Dosimetry Data Base for the Workers at the Mayak Production Association."
- Implement dose-reconstruction work to support the epidemiologic investigation of one or more cohorts exposed to the effluent from the Mayak facility, and
- Coordinate the dosimetry studies for the worker population being studied in Direction 2, "Researches on Medical Consequences of Personnel Exposure to Radiation."

II. Background (includes relevance to DOE programs)

This is continuation of work performed under the 1994 Agreement Between the Government of the United States and the Government of the Russian Federation on Cooperation in Research on Radiation Effects for the Purpose of Minimizing the Consequences of Radioactive Contamination on Health and the Environment. This work is being coordinated by the Joint Coordinating Committee for Radiation Effect Research (JCCRER), for which the Department of Energy (DOE), Office of International Heath Programs (EH-63) is the U.S. Chairman. The primary goal is conducting research on radiogenic health effects concerning past exposures that occurred in Russia.

Population exposure in the Urals occurred as a result of failures in the technological processes at the Mayak plutonium facility in the 1950's. Construction of the Mayak facility began in 1945 and was completed in 1948. Initially this complex consisted of three main parts: Reactor plant, radiochemical facility, and waste-management facilities. The major sources of radioactive contamination were the discharges of 2.7 10^6 Ci of liquid wastes into the Techa River (1949–1956); an explosion in the radioactive waste-storage facility in 1957 (the so-called Kyshtym Accident) that formed the East Urals Radioactive Trace (EURT) due to dispersion of 2 10^6 Ci into the atmosphere; and gaseous aerosol releases (about 560,000 Ci of ^{131}I in total) within the first decades of the facility's operation. The significant portion of activity for the Techa River and EURT consists of long-lived radionuclides, mainly ^{90}Sr. These releases resulted in the long-lived contamination of surrounding territories. The predominant radionuclide for operating gaseous aerosol releases was short-lived ^{131}I that resulted from the processing of nuclear fuel for the extraction of Pu.

Systematic measurements of radioactive contamination in and near the Techa River started in the summer of 1951. The contamination of the river water, bottom sediments, flood-plain soils, vegetation, fish, milk, and other food stuffs, and external gamma-exposure rates were measured. In 1957 the monitoring was expanded to include the area covered by the EURT. Systematic control of the Mayak operating releases and

measurements of ^{131}I concentration in food stuffs started only in 1962. For the town of Ozersk (which was the living place of the workers at the MPA and which was mostly affected by gaseous aerosol releases) regular measurements of ^{90}Sr and ^{137}Cs started in 1956, and the monitoring of exposure rates began in 1964. The results of all these measurements are kept in archives at the Mayak facility and the Urals Research Center on Radiation Medicine (URCRM), mainly on paper media (maps, working notebooks, technical reports, etc.). Some of them are still classified.

The population of the contaminated territories was exposed to external and chronic internal irradiation. Medical checkups of people living in the Techa Riverside communities had been started by 1951. In addition to medical examinations, individual data on the conditions of contact with the contaminated river (the distance of the house from the water's edge, the source of drinking water, fishing, etc.) were collected. Also, radiometric measurements of bioassay and autopsy samples were performed. Medical checkups of the population of the most contaminated area of the EURT were started in autumn 1957. Later, a registry numbering 90,000 subjects in the accidentally exposed population (the residents of the Techa Riverside communities and the residents of the area covered by the EURT) was established at the URCRM. All places and terms of residence inside the contaminated area were collected for the members of this registry for the purposes of individual-dose reconstruction. Also, extensive measurements of ^{90}Sr content in teeth were performed beginning in 1960 and in forehead bone beginning in 1976; whole-body counting for ^{90}Sr has been performed since 1974. Now the main part of this information is contained in a computerized data base at the URCRM. The registry for the population exposed as a result of the operational releases at the Mayak facility is not established yet, but this work has been started at Branch 1 of the Moscow Biophysics Institute (FIB-1). Also, the results of measurements of ^{90}Sr and Pu in samples collected at autopsy for the residents of Ozersk and nearby territories number several thousand and are kept in the archives of the Mayak facility and the FIB-1. So, three cohorts of exposed populations can be selected based on the nature of exposure and according to the history of follow-up and available data. These are the Techa River Cohort, the EURT Cohort and the Ozersk Cohort (not yet established). Some efforts addressed to dose reconstruction and risk assessment for the first two cohorts were taken in the URCRM and the results have been published in the open literature (see Section VI).

In addition there are a few thousand early workers at the Mayak facility who have been enrolled in an epidemiologic study. These workers have received a dose of about 1 Gy or more from external exposure, and many of them also have significant doses from the inhalation of Pu. There is a substantial amount of work that must be done in order to have a validated data base of both external and internal doses for the workers in this study.

The DOE is currently responsible for a very large workforce of radiological workers. A key component of that responsibility is to know as precisely as possible what the risk is from exposure to radiation. The doses received by this population of U.S. workers is sufficiently low so that it is not possible to assess the risk in this U.S. population, and most estimates of risk are currently derived from studies of the Japanese survivors of the atomic bombings. However, the Japanese exposure was instantaneous, and not at all like the low-dose-rate exposure received by workers and the general populations of interest in the U.S. Thus, more accurate information on radiogenic risks of low-to-moderate doses received at low-dose rates can be achieved only by the study of other populations. The populations exposed as a result of emissions from the Mayak facility are a unique resource for this purpose.

III. Methods and Approach

Much of the effort for this project is concerned with the dose reconstruction for the general population. We have prepared a detailed proposal for how this dose reconstruction might be carried out: emphasis was on the Techa River Cohort, although the EURT and the Ozersk Cohorts were considered, also. The approach that was developed was strongly dependent upon current and future measurements of ^{90}Sr in bodies, teeth, and bones, the measurement of electron paramagnetic resonance in teeth, and the measurement of external exposures from the study of thermoluminescent signals in environmental materials. We also proposed a reconstruction process based on a development of the time-dependent source term, although the availability of currently classified data is problematic.

The methods that we proposed for the accomplishment of the dose reconstruction for the public have been challenged by the Scientific Review Groups (SRG) of the U.S. and Russia. However, the recommendations of the two SRG's are also in direct conflict. The scope of the study has also been challenged, but this is primarily a financial issue. The first activity that must be undertaken is to resolve the funding issues, resolve the issues raised by the SRGs, and to then prepare a modified proposal for the future work.

For the workers, the primary task is to ensure that the most up-to-date external and internal doses are available for the individual workers in the study. This work will be accomplished by working closely with the external dosimetry personnel at the Mayak facility and with the plutonium-body-burden group at FIB-1. They have access to measurements of Pu excretion in urine for virtually the entire cohort, but care must be taken to ensure that the body burdens and the doses are all recalculated with a uniform and validated method of deriving these parameters from the urinary excretion measurements.

IV. Suggested Performance Indicators

The primary performance indicators should be the completion of the suggested (or negotiated) milestones. As this project is a scientific study, the ultimate performance indicator should be the successful publication of meaningful results in peer-reviewed journals.

V. References (Literature)

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5) *Dosimetry Research and Risk Analysis in Ukraine and Belarus of Those Affected by the Chernobyl Accident: (Principal Investigator: Lynn Anspaugh)*

I. Concise Statement of Goals

Acting in collaboration with our colleagues from institutes in Ukraine, Belarus, Russia, and the United States we will

- Provide required dosimetry expertise to support the DOE-sponsored Ukraine Eye-Cataract in Liquidator Study, and
- Continue ongoing data analyses on dose-reconstruction efforts that are required to complete manuscripts of past EH-funded efforts.

II. Background (includes relevance to DOE programs)

The Principal Investigator has been involved in dose reconstruction and risk assessment for most of his professional life. A major activity was the dose reconstruction for the persons living nearby the Nevada Test Site. Methods developed for that study were modular and were readily applied to the Chernobyl accident. The results of a DOE-funded preliminary dose reconstruction, dose projection, and risk assessment were published soon after the accident (Anspaugh et al. 1988a) and we also participated in the first UNSCEAR analysis (Anspaugh et al. 1988b) of the accident. Since 1989 we have been working on dosimetry and risk-assessment problems related to Chernobyl that began and continue under the auspices of the Joint Coordinating Committee on Civilian Nuclear Reactor Safety. The immediate goals of this program were to understand the accident in general terms and to develop methods of rapidly projecting the dose and effects of any future nuclear reactor accident. In recent times the goal has been more focused on epidemiologic studies and the dosimetry needed to support such studies.

As part of the EH-63 program, there have been several epidemiologic studies under development. A case-control study of childhood-thyroid cancer in Belarus has been completed and submitted for publication (Astakhova et al. submitted) and a cohort study of eye-lens cataracts in liquidators has been underway for about one year. Several other studies have been under planning for many years, but are not yet implemented. These include cohort studies of childhood-thyroid cancer in Belarus and Ukraine and a case-cohort study of leukemia in liquidators in Ukraine. A dosimetry-research study has been ongoing in Ukraine since March 1996. We

were initially involved in all of the studies mentioned above, but, due to the recent position taken by the DOE in regard to the studies being planned by the NCI (with financial support from the DOE), we will no longer continue our active involvement in the cohort studies of childhood-thyroid cancer or the case-cohort study of leukemia in liquidators. As a result, we view this year to be one of transition. It is our plan to focus in the future mainly on the ongoing study of eye-cataract formation in liquidators and on continuing the dosimetry-research studies in Ukraine, but to add a risk-assessment component in a new proposal for the dosimetry-research studies.

We will complete our involvement in several NCI-related scientific studies that are in process through the publication of results. We plan a much greater involvement in performing research on general methods of dosimetry that will be needed to support long-term epidemiologic studies, particularly as they pertain to the liquidators. The problems of inferring the beta dose to the eyes of the liquidators and the external gamma dose to the bone marrow of the liquidators are particularly difficult.

One of our currently planned activities is to propose a risk-assessment component to our dosimetry-research studies. By carefully following the incidence of certain types of cancers and by knowing the collective dose to the underlying population, it is possible to define radiogenic factors without the expense of performing a cohort study. An example of such a study is the paper by Sobolev et al. (submitted). Such an epidemiologic study is referred to as an "ecologic" study. The data that can be derived from such studies are subject to larger uncertainties, but, in this case, the radiation dose was so large and the incidence (at least for childhood-thyroid cancer) so large, that the uncertainty will be much less than for typical ecologic studies. In addition, this backup position will be most valuable in case the NCI-related epidemiologic studies are not successful.

As indicated in the paragraph above, it is important to be able to define the collective dose that underlying populations have received. This will also continue to be a major thrust of our planned activities.

The DOE is currently responsible for a very large workforce of radiological workers. A key component of that responsibility is to know as precisely as possible what the risk is from exposure to radiation. The doses received by this population of U.S. workers is sufficiently low so that it is not possible to assess the risk in this U.S. population. The most estimates of risk are currently derived from studies of the Japanese survivors of the atomic bombings. However, the Japanese exposure was instantaneous, and not at all like the low-dose-rate exposure received by workers and the general populations of interest in the U.S. Thus, more accurate information on radiogenic risks of low-to-moderate doses received at low-dose rates

can be achieved only by the study of other populations. The populations exposed as a result of the Chernobyl accident are a unique resource for this purpose.

III. Methods and Approach

Many different methods and approaches are being used to investigate the complex problems that are being addressed. All of the work requires a close collaborative working relationship with the investigators from the Former Soviet Union, as they have access to critical data needed for all of the studies. Such data consists of hundreds of thousands of measurements of children's thyroid glands after the accident, more than a million measurements of the whole-body content of radiocesiums in the body of adults and children, about one million measurements of radiocesiums in milk, more than 100,000 TLD measurements of external exposure, and several million measurements of the deposition density of radiocesium on soil. In addition for the liquidators, there are many measurements of dose (but only at times relatively late) and there are measurements of external gamma (and some beta) fluxes at several locations within the Chernobyl-NPP complex.

These existing radiometric data are being assembled and analyzed in order to determine a variety of desired results. Included are the individual and collective external and internal doses to the general population. These important results (e.g., Likhtarev et al. 1996; Likhtarev et al. submitted), and their variation with time, will continue to be one of the significant outputs of our activities.

For the more difficult situation for the liquidators, we are working with other scientists at the University of Utah and the Ukrainian Radiation Protection Institute to develop and validate other useful techniques. These include the electron paramagnetic resonance analysis of teeth and the application of computer-based algorithms. The latter activity will become more important, as it is necessary to develop doses for a large number of individuals.

A new activity during the past year, and one that we will continue, is the derivation of radiogenic risk factors through the conduct of "ecologic" epidemiological studies. This requires a close working relationship with local pathologists and epidemiologists. Example results have been submitted for publication (Soboiev et al. submitted; Likhtarev et al. submitted).

Finally, we continue to examine additional methods that can be used to infer doses. One example is the companion work being performed at the University of Utah on the use of iodine-129 as a surrogate for the deposition density of iodine-131. Another nagging problem relates to the relative importance of the shorter-lived radioiodines (the epidemiologists are not willing to concede that the epidemic of

childhood-thyroid cancer can be due to dose from iodine-131); *calculated* data on the inventory of such species in the reactor indicates that the shorter lived radioiodines were not significant but there has not been any real data available. We have located an institute in Russia that we believe has access to data that could be critically important in resolving this issue.

IV. Suggested Performance Indicators

The primary performance indicators should be the completion of the suggested (or negotiated) milestones. As this project is a scientific study, the ultimate performance indicator should be the successful publication of meaningful results in peer-reviewed journals.

V. References (Literature) - Relationship to Other Projects

L.R. Anspaugh, R.J. Catlin, and M. Goldman, "The Global Impact of the Chernobyl Reactor Accident," *Science* 242, 1513–1519 (1988a).

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I.A. Likhtarev, L.N. Kovgan, S.E. Vavilov, R.R. Gluvchinsky, O.N. Perevoznikov, L.N. Litvinets, L.R. Anspaugh, I.R. Kercher and A. Bouville, "Internal Exposure from the Ingestion of Foods Contaminated by ^{137}Cs after the Chernobyl Accident," *Health Phys.* 70, 297–317 (1996).

I.A. Likhtarev, L.N. Kovgan, B.G. Soboiev, L.R. Anspaugh, and A.C. Bouville, "Collective Radiation Doses and Related Risks for the General Population of Ukraine from the Chernobyl Accident," submitted.

B.G. Sobolev, I.A. Likhtarev, I.A. Kairo, N.V. Kartashov, N.D. Tronko, V.A. Olevnik, T.I. Bogdanova, V.V. Epstein, G. Gouilko, A. Bouville, L.R. Anspaugh, "Relationship Between Exposure to ^{131}I and Increase in Incidence of Thyroid Cancer in Ukraine Among People Exposed in Childhood to Radiation Resulting from the Chernobyl Accident," *Submitted to Radiation Research* (1996) Preprint UCRL-JC-123708, in revision, October 1996).

BUDGET EXPLANATION PAGE FOR FORM ER 4620.1

1. Hiroshima Neutron Dosimetry (Principal Investigator: Tore Straume)

Please provide detailed data, in narrative form, to support each Cost Category as follows:

1. Personnel

a. Identify each position to be supported under the proposed award by title.

Research Professor, Tore Straume
Research Associate, Alfredo Marchetti
Graduate Student, to be named

b. Briefly, specify the duties of professionals to be compensated under this project.

Tore Straume - Project director, has overall responsibility for the project, will define and coordinate the research, write reports and papers.

Alfredo Marchetti - Laboratory chemist, responsible for the technical aspects and quality control of the ^{63}Ni and ^{36}Cl extraction and sample prep laboratory. Will also assist in data analysis, evaluation of results, and the writing of reports and papers.

Graduate student to be hired - primary duties will be to provide technical support in the Hiroshima sample lab, e.g., assist Marchetti in the extraction of Ni from Hiroshima copper samples, extract Cl from concrete samples, prepare samples for analysis by AMS, prepare solutions, and otherwise perform a variety of routine duties in the lab.

c. State the amounts of time, such as hours or percentage of time to be expended by each position under this project

Research Professor - 25%
Research Associate - 25%
Graduate Student - 37.5%

d. State the amount of compensation to be paid each employee, student, or assistant under this project.

Research Professor - $24.875
Research Associate - $10.000
Graduate Student - $6.225

Personnel costs are increased by 5% for year 2.

e. State whether the proposed compensation is consistent with that paid other personnel engaged in similar work both within and outside your organization.

The salaries are based on guidelines applied uniformly throughout the university. They are competitive with salaries paid by outside industries when the fringe benefits are taken into account.

2. FRINGE BENEFITS

a. Indicate the basis for compensation of rates, including the types of benefits to be provided.

Retirement - 15%
Health care and life insurance - 10%
Social Security - 7.65%
Long term disability, additional life insurance, etc. - balance

Personnel costs and fringe benefits are increased by 5% each year.

3. TRAVEL

a. Identify total foreign and domestic travel as separate items.

Foreign travel - $7,670 for first year.

b. Indicate the estimated number of trips, points of origin and destination, and purpose of travel.

Foreign travel	
Hiroshima, Japan	Sampling trip
Munich, Germany	^{63}Ni AMS measurements

c. For each trip, itemize the estimate of transportation and/or subsistence costs.

	Air fare	Lodging	Per diem	Total
Hiroshima	$2,300	$725	$960	$3,985
Munich	$1,695	$800	$960	$3,685

d. Specify the basis for computation of each type of travel expense (e.g., current airline ticket quotes, past trips of similar nature, federal government of organization travel policy, etc.).

Air rates are current airline ticket quotations. Per diem is based on university policy. Hotels rates have been determined from previous experience.

Travel is increased by 5% per year for subsequent years.

4. EQUIPMENT

a. Indicate the esumated unit cost for each item to be purchased.

b. Provide basis for cost estimates.

c. Briefly justify the need for items of equipment to be purchased.

5. MATERIALS AND SUPPLIES

a. Itemize materials and supplies estimates by nature of expense.

Glassware	1,900
Target holders	3,000
Chemicals	2,500
Gases	1,800
Materials related to Ni extraction	3,500
Materials related to Cl extraction	1,600
Publications	2,500
Office supplies	700

b. Provide the basis for cost estimates or computations (e.g., vendor quotes, prior purchase of similar or like items, etc.).

Previous experience on requirement for doing the operations described in the proposal.

6. CONTRACTS AND SUBGRANTS

AMS analysis of ^{36}Cl and ^{63}Ni (LLNL and Munich)	17,500

7. OTHER

a. List items by major type.

Long distance phone charges	1,000
Maintenance	2,000

b. Provide basis for cost estimates or computations.

Previous experience with similar items.

c. State whether contingency reserves are included in this category.

No.

8. INDIRECT COSTS

a. State whether the amount requested is based on a rate approved by a Federal Agency.

The indirect cost rate was negotiated by the University and DOE.

b. If no indirect cost agreement approved by a Federal Agency exists, state the basis for the amount requested.

Not applicable.

BUDGET EXPLANATION PAGE FOR FORM ER 4620.1

2. I-129 Dosimetry (Principal Investigator: Tore Straume)

Please provide detailed data, in narrative form, to support each Cost Category as follows:

1. Personnel

   a. Identify each position to be supported under the proposed award by title.

   Research Professor, Tore Straume
   Research Associate, Alfredo Marchetti
   Graduate Student, to be named

   b. Briefly, specify the duties of professionals to be compensated under this project.

   Tore Straume - Project director, has overall responsibility for the project, will define and coordinate the research, write reports and papers.

   Alfredo Marchetti - Laboratory chemist, responsible for the technical aspects and quality control of the iodine measurement laboratory. Will aslo assist in data analysis, evaluation of results, and the writing of reports and papers.

   Graduate Student to be hired - primary duties will be to provide technical support in the iodine lab, e.g., prepare samples for iodine analysis for both total iodine concentration and I-129, operate the gas chromatograph, prepare solutions, and otherwise perform a variety of routine duties in the lab.

   c. State the amounts of time, such as hours or percentage of time to be expended by each position under this project

   Research Professor - 25%
   Research Associate - 25%
   Graduate Student - 37.5%

   d. State the amount of compensation to be paid each employee, student, or assistant under this project.

   Research Professor - $24,875
   Research Associate - $10,000
   Graduate Student - $6,225

   Personnel costs are increased by 5% for year 2.

   e. State whether the proposed compensation is consistent with that paid other personnel engaged in similar work both within and outside your organization.

   The salaries are based on guidelines applied uniformly throughout the university. They are competitive with salaries paid by outside industries when the fringe benefits are taken into account.

2. FRINGE BENEFITS

a. Indicate the basis for compensation of rates, including the types of benefits to be provided.

Retirement - 15%
Health care and life insurance - 10%
Social Security - 7.65%
Long term disability, additional life insurance, etc. - balance

Personnel costs and fringe benefits are increased by 5% each year.

3. TRAVEL

a. Identify total foreign and domestic travel as separate items.

Foreign travel - $9,738 for first year.

b. Indicate the estimated number of trips, points of origin and destination, and purpose of travel.

Foreign travel	
Minsk, Belarus	Soil sampling expedition
Salt Lake City	Training at University of Utah for Minsk chemist

c. For each trip, itemize the estimate of transportation and/or subsistence costs.

	Air fare	Lodging	Per diem	Total
Minsk	$1,998	$1,280	$1,260	$4,938
Salt Lake City	$2,000	$1,280	$1,200	$4,800

d. Specify the basis for computation of each type of travel expense (e.g., current airline ticket quotes, past trips of similar nature, federal government of organization travel policy, etc.).

Air rates are current airline ticket quotations. Per diem is based on university policy. Hotels rates have been determined from previous experience.

Travel is increased by 5% per year for subsequent years.

4. EQUIPMENT

a. Indicate the estimated unit cost for each item to be purchased.

b. Provide basis for cost estimates.

c. Briefly justify the need for items of equipment to be purchased.

5. MATERIALS AND SUPPLIES

a. Itemize materials and supplies estimates by nature of expense.

Glassware	1,900
Glass blowing	2,000
Chemicals	2,000
GC gases	2,000
Office supplies	600
Publication costs	1,500
General lab supplies	1,800
Furnaces (2)	3,200

b. Provide the basis for cost estimates or computations (e.g., vendor quotes, prior purchase of similar or like items, etc.).

Previous experience on requirement for doing the operations described in the proposal.

6. CONTRACTS AND SUBGRANTS

AMS analysis of I-129 (Purdue University)	9,500

7. OTHER

a. List items by major type.

Long distance phone charges	400
Maintenance of equipment	1,000

b. Provide basis for cost estimates or computations.

Previous experience with similar items.

c. State whether contingency reserves are included in this category.

No.

8. INDIRECT COSTS

a. State whether the amount requested is based on a rate approved by a Federal Agency.

The indirect cost rate was negotiated by the University and DOE.

b. If no indirect cost agreement approved by a Federal Agency exists, state the basis for the amount requested.

Not applicable.

BUDGET EXPLANATION PAGE FOR FORM ER 4620.1

3. *Retrospective Dosimetry Using Electron Paramagnetic Resonance (EPR) and Thermoluminescence (TL) Techniques in Contaminated Areas of the Former Soviet Union (Principal Investigator: Edwin Haskell)*

Please provide detailed data, in narrative form, to support each Cost Category as follows:

1. Personnel

   a. Identify each position to be supported under the proposed award by title.

   Research Assistant Professor
   Research Associate
   Graduate Student
   Technician
   Work study student

   b. Briefly, specify the duties of professionals to be compensated under this project.

   Ed Haskell - Project director, coordinate research, write reports and papers.

   Gerry Kenner - Data analysis, evaluate results, writes reports and papers.

   Rob Hayes - Prepares specimens, operates EPR, summarizes and evaluates results.

   c. State the amounts of time, such as hours or percentage of time to be expended by each position under this project.

   Research Assistant Professor - 60%
   Research Associate - 60%
   Graduate Student - 60%
   Technician - 50%
   Work Study Student - 50%

   d. State the amount of compensation to be paid each employee, student or assistant under this project.

   Research Assistant Professor - $36.438
   Research Associate - $24.324
   Graduate Student - $17.089
   Technician - $7.529
   Work Study Student - $1.818

   Personnel costs are increased by 5% for year 2.

   e. State whether the proposed compensation is consistent with that paid other personnel engaged in similar work both within and outside your organization.

The salaries are based on guidelines applied uniformly throughout the university. They are competitive with salaries paid by outside industries when the fringe benefits are taken into account.

2. FRINGE BENEFITS

a. Indicate the basis for compensation of rates, including the types of benefits to be provided.

Retirement - 15%
Health care and life insurance - 10%
Social Security - 7.65%
Long term disability, additional life insurance, etc. - balance

Personnel costs and fringe benefits are increased by 5% each year.

3. TRAVEL

a. Identify total foreign and Domestic Travel as separate items.

Foreign travel - $8,480 for first year.

b. Indicate the estimated number of trips, points of origin and destination, and purpose of travel.

All trips would be from Salt Lake City, Utah.

Foreign travel	
Russia/Ukraine	Field collection
Urals	Consultation and training

c. For each trip, itemize the estimate of transportation and/or subsistence costs.

	Air fare	Lodging	Per diem	Total
Russia/Ukraine	$2,000	$1,280	$960	$4,240
Urals	$2,000	$1,280	$960	$4,240

d. Specify the basis for computation of each type of travel expense (e.g., current airline ticket quotes, past trips of similar nature, federal government of organization travel policy, etc.).

Air rates are current airline ticket quotations. Per diem is based on university policy. Hotels rates have been determined from previous experience.

Travel is increased by 5% per year for subsequent years.

4. EQUIPMENT

a. Indicate the estimated unit cost for each item to be purchased.

b. Provide basis for cost estimates.

c. Briefly justify the need for items of equipment to be purchased.

5. MATERIALS AND SUPPLIES

a. Itemize materials and supplies estimates by nature of expense.

Dosimeters	1,300
Screens, saw blades	1,430
Glassware	1,202
Computer storage media	330
Chemicals and gases	900
Office supplies	600
Publication costs	3,000
Temp controlled ultrasonic cleaner	1050

b. Provide the basis for cost estimates or computations (e.g., vendor quotes, prior purchase of similar or like items, etc.).

Previous experience on requirement for doing the operations described in the proposal.

6. CONTRACTS AND SUBGRANTS

None.

7. OTHER

a. List items by major type.

Long distance phone charges	200
Maintenance	6,000

b. Provide basis for cost estimates or computations.

Previous experience with similar items.

c. State whether contingency reserves are included in this category.

No.

8. INDIRECT COSTS

a. State whether the amount requested is based on a rate approved by a Federal Agency.

The indirect cost rate was negotiated by the University and DOE.

b. If no indirect cost agreement approved by a Federal Agency exists, state the basis for the amount requested.

Not applicable.

BUDGET EXPLANATION PAGE FOR FORM ER 4620.1

4) *Dosimetry and Risk Assessment as Related to Cohorts Exposed to the Radioactive Contamination from Mayak Facility (Principal Investigator: Lynn Anspaugh)*

Please provide detailed data, in narrative form, to support each Cost Category as follows:

1. Personnel

   a. Identify each position to be supported under the proposed award by title.

      Research Professor, Lynn Anspaugh

   b. Briefly, specify the duties of professionals to be compensated under this project.

      Lynn Anspaugh - Project director, has overall responsibility for the project, will define and coordinate the research, write reports and papers.

   c. State the amounts of time, such as hours or percentage of time to be expended by each position under this project

      Research Professor - 50%

   d. State the amount of compensation to be paid each employee, student, or assistant under this project.

      Research Professor - $ 60,000

      Personnel costs are increased by 5% for year 2.

   e. State whether the proposed compensation is consistent with that paid other personnel engaged in similar work both within and outside your organization.

      The salaries are based on guidelines applied uniformly throughout the university. They are competitive with salaries paid by outside industries when the fringe benefits are taken into account.

2. FRINGE BENEFITS

   Indicate the basis for compensation or rates, including the types of benefits to be provided.

   Retirement - 15%
   Health care and life insurance - 10%
   Social Security - 7.65%
   Long term disability, additional life insurance, etc. - balance

   Personnel costs and fringe benefits are increased by 5% each year.

3. TRAVEL

a. Identify total foreign and domestic travel as separate items.

Foreign travel - $16.000 for first year.
Domestic travel - $6.000 for first year

b. Indicate the estimated number of trips, points of origin and destination, and purpose of travel.

Foreign travel
Four trips to Chelyabinsk, Russia Coordination with Russian collaborators
Two trips to Washington Attend meetings at DOE

c. For each trip, itemize the estimate of transportation and/or subsistence costs.

	Air fare	Lodging	Per diem	Total
Chelyabinsk	2,000	650	1350	4000
Chelyabinsk	2,000	650	1350	4000
Chelyabinsk	2,000	650	1350	4000
Chelyabinsk	2,000	650	1350	4000
Washington	1,200	520	280	2000
Washington	1,200	520	280	2000
Washington	1,200	520	280	2000

d. Specify the basis for computation of each type of travel expense (e.g., current airline ticket quotes, past trips of similar nature, federal government of organization travel policy, etc.).

Air rates are current airline ticket quotations. Per diem is based on university policy. Hotels rates have been determined from previous experience.

Travel is increased by 5% per year for subsequent years.

4. EQUIPMENT

a. Indicate the estimated unit cost for each item to be purchased.

b. Provide basis for cost estimates.

c. Briefly justify the need for items of equipment to be purchased.

5. MATERIALS AND SUPPLIES

a. Itemize materials and supplies estimates by nature of expense.

Publication costs	5,000
Office supplies	2,250

b. Provide the basis for cost estimates or computations (e.g., vendor quotes, prior purchase of similar or like items, etc.).

Previous experience on requirement for doing the operations described in the proposal.

6. CONTRACTS AND SUBGRANTS

7. OTHER

a. List items by major type.

Long distance phone charges	2,250
Maintenance of equipment	0

b. Provide basis for cost estimates or computations.

Previous experience with similar items.

c. State whether contingency reserves are included in this category.

No.

8. INDIRECT COSTS

a. State whether the amount requested is based on a rate approved by a Federal Agency.

The indirect cost rate was negotiated by the University and DOE.

b. If no indirect cost agreement approved by a Federal Agency exists, state the basis for the amount requested.

Not applicable.

BUDGET EXPLANATION PAGE FOR FORM ER 4620.1

5) *JCCCNRS Dosimetry Research and Risk Analysis (Principal Investigator: Lynn Anspaugh)*

Please provide detailed data, in narrative form, to support each Cost Category as follows:

1. Personnel

   a. Identify each position to be supported under the proposed award by title.

   Research Professor, Lynn Anspaugh

   b. Briefly, specify the duties of professionals to be compensated under this project.

   Lynn Anspaugh - Project director, has overall responsibility for the project, will define and coordinate the research, write reports and papers.

   c. State the amounts of time, such as hours or percentage of time to be expended by each position under this project

   Research Professor - 25%

   d. State the amount of compensation to be paid each employee, student, or assistant under this project.

   Research Professor - $30,000

   Personnel costs are increased by 5% for year 2.

   e. State whether the proposed compensation is consistent with that paid other personnel engaged in similar work both within and outside your organization.

   The salaries are based on guidelines applied uniformly throughout the university. They are competitive with salaries paid by outside industries when the fringe benefits are taken into account.

2. FRINGE BENEFITS

   a. Indicate the basis for compensation or rates, including the types of benefits to be provided.

   Retirement - 15%
   Health care and life insurance - 10%
   Social Security - 7.65%
   Long term disability, additional life insurance, etc. - balance

   Personnel costs and fringe benefits are increased by 5% each year.

3. TRAVEL

a. Identify total foreign and domestic travel as separate items.

Foreign travel - $16.000 for first year.
Domestic travel - $6,000 for first year

b. Indicate the estimated number of trips, points of origin and destination, and purpose of travel.

Foreign travel
Four trips to Ukraine and Belarus — Coordination with Ukrainian and other collaborators

c. For each trip, itemize the estimate of transportation and/or subsistence costs.

	Air fare	Lodging	Per diem	Total
Kiev	2.000	800	1200	4000
Kiev	2.000	800	1200	4000
Kiev	2.000	800	1200	4000
Minsk	2.000	800	1200	4000
Washington	1,200	520	280	2000
Washington	1,200	520	280	2000
Washington	1,200	520	280	2000

d. Specify the basis for computation of each type of travel expense (e.g., current airline ticket quotes, past trips of similar nature, federal government of organization travel policy, etc.).

Air rates are current airline ticket quotations. Per diem is based on university policy. Hotels rates have been determined from previous experience.

Travel is increased by 5% per year for subsequent years.

4. EQUIPMENT

a. Indicate the estimated unit cost for each item to be purchased.

Computer, year 2

b. Provide basis for cost estimates.

Estimate based on current advertised prices.

c. Briefly justify the need for items of equipment to be purchased.

Modern computer for communication, preparation of reports and analysis of data.

5. MATERIALS AND SUPPLIES

a. Itemize materials and supplies estimates by nature of expense.

Publication costs	$5.000
Office supplies	$2.250

b. Provide the basis for cost estimates or computations (e.g., vendor quotes, prior purchase of similar or like items, etc.).

Previous experience on requirement for doing the operations described in the proposal.

6. CONTRACTS AND SUBGRANTS

7. OTHER

a. List items by major type.

Long distance phone charges	2.250
Maintenance of equipment	0

b. Provide basis for cost estimates or computations.

Previous experience with similar items.

c. State whether contingency reserves are included in this category.

No.

8. INDIRECT COSTS

a. State whether the amount requested is based on a rate approved by a Federal Agency.

The indirect cost rate was negotiated by the University and DOE.

b. If no indirect cost agreement approved by a Federal Agency exists, state the basis for the amount requested.

Not applicable.

BIOGRAPHICAL SKETCH

NAME	POSITION TITLE
Straume, Tore	**Research Professor, University of Utah, Radiobiology Division**

INSTITUTION AND LOCATION	DEGREE	YEAR CONFERRED	FIELD OF STUDY
University of Washington	B.S.	1973	Biological Science
University of Washington	M.S	1975	Radiological Sciences
University of California, Davis	Ph.D.	1982	Biophysics

EMPLOYMENT

University of Utah
1996-present Research Professor, Radiobiology Division

Lawrence Livermore National Laboratory, Livermore, California
1992-1996 Group Leader, dosimetry technology development.
1989-1992 Section Leader, risk assessment.
1982-1989 Senior Biophysicist, radiobiology, FISH development.
1979-1982 Research Scientist, reproductive biology.
1975-1982 Health Physicist.

HONORS AND NATIONAL COMMITTEES

1991-present Member, National Academy of Sciences Working Group on Hiroshima Dosimetry.
1995-Present Member, NCRP Committee 93, Radiation Measurements, National Council on Radiation Measurements.
1994-present Professor of Physics (Adjunct), California State University, San Jose, California.
1994-present Professor of Biology (Adjunct), California State University, Hayward, California.
1993-present Principal Investigator, Chromosome Painting Dosimetry, DOE.
1992-present Principal Investigator, Biodosimetry Tools, DOE.
1992-present Principal Investigator, Thyroid Dosimetry at Chernobyl, LDRD & DOE.
1991-Present Co-Principal Investigator, Radiosensitive Target in the Early Mouse Embryo, NIH.
1988-1993 Co-Chairman, Committee on Risk Assessment, Health Physics Society.
1988-present Principal Investigator, Hiroshima Dosimetry, DOE.
1987-present Associate Editor, Health Physics Journal.
1983-1987 Principal Investigator, "chromosome painting" technology, LLNL.
1973-1975 U.S. Public Health Services Radiological Health Traineeship.

PUBLICATIONS (selected from over 100 scientific papers and reports)

In press T. Straume, L.R. Anspaugh, J.N. Lucas, et al., Challenges in dose reconstruction: examples from Chernobyl, Hiroshima, biomarkers, and environmental materials. *Radiat. Res.* (in press)

In press T. Straume, O. G. Raabe, K.J. Walsh, and L.M. Wiley, Inherited proliferation disadvantage from mouse oocytes labeled *in vivo* with ^{3}H-thymidine: radiosensitive target considerations. *Mutat. Res.* (in press).

In press Lucas, J. N., Hill, F.S., Burk, C.E., Cox, A.B., **Straume, T.**, Stability of the translocation frequency following whole-body irradiation measured in rhesus monkeys. *Int. J. Radiation Biol.* (in press)

1996 T. Straume, A.A. Marchetti, L.R. Anspaugh, et al., The feasibility of using ^{129}I to reconstruct ^{131}I deposition from the Chernobyl reactor accident. *Health Phys.* 71, 1–8.

1996 T. Straume, A.A. Marchetti, J.E. McAninch, New analytical capability may provide solution to the neutron problem in Hiroshima. *Radiat. Prot. Dosim.* 67, 5–8.

1996 T. Straume, Risk implications of the neutron discrepancy in the Hiroshima DS86 dosimetry system. *Radiat. Prot. Dosim.* 67, 9–12.

1995 T. Straume, High-energy gamma rays in Hiroshima and Nagasaki: implications for risk and w_R. *Health Phys.* 69, 954–956.

1995 T. Straume and J. Lucas, Validation studies for monitoring of workers using molecular cytogenetics. Biomarkers in Occupational Health: Progress and Perspectives (M. L. Mendelsohn, J. P. Peeters, and M. J. Normandt, Eds.), Joseph Henry Press, Washington DC. pp. 174-193.

1995 Lucas, J. N., Hill, F., Burk, C., Fester, T., **Straume, T.** The ^{60}Co gamma-ray dose-response curve for reciprocal translocations: linear slope at low doses measured using chromosome painting. *Health Physics* 68, 761-765 (1995).

1994 T. Straume, L.J. Harris, A.A. Marchetti and S.D. Egbert, "Neutrons confirmed in Nagasaki and at the Army Pulsed Radiation Facility: Implications for Hiroshima." *Radiat. Res.* **138**, 193–200.

1994 J. Lucas, F. Hill, G. Swansbury, R. Clutterbuck, and **T. Straume**, Discrimination between leukemia- and non-leukemia-induced chromosomal abnormalities in the patient's lymphocytes. *Int. J. Radiat. Biol.*, **66**, 385-389.

1993 T. Straume, O.G. Raabe, K.J. Walsh and L.M. Wiley, "Inherited effects from irradiated mouse immature oocytes detected in aggregation embryo chimeras," *Mutat. Res.* **287**, 243-251.

1993 T. Straume and J. N. Lucas, A comparison of the yields of translocations and dicentrics measured using fluorescence *in situ* hybridization. Int. J. Radiat. Biol. **64**,185-187.

1993 T. Straume, "Tritium risk assessment," *Health Phys.* **65**, 673–682.

1993 T.Straume and A.L. Carsten, "Tritium radiobiology and relative biological effecuveness," *Health Phys.* **65**, 657–672.

1993 Lucas, J.N., Poggensee, M., Straume, T., Translocations between two specific human chromosomes detected by three-color 'chromosome painting', *Cytogenet. Cell Genet.* **62**, 11-12.

1992 T. Straume, J.N. Lucas, J.D. Tucker, W.L. Bigbee, and R.G. Langlois, "Biodosimetry for a Radiation Worker Using Multiple Assays," *Health Phys.* **62**, 122–130.

1992 J.N. Lucas, M. Poggensee and T. Straume, "The Persistence of Chromosome Translocations in a Radiation Worker Accidentally Exposed to Tritium," *Cytogenet. Cell Genet.* **60**, 255–256.

1992 T. Straume, S. Egbert, W.A. Woolson, R.C. Finkel, P.W. Kubik, H.E. Gove, P. Sharma and M. Hoshi,"Neutron Discrepancies in the DS86 Hiroshima Dosimetry System," *Health Phys.* **63**, 421–426.

1992 Lucas, J.N., Awa, A., Straume, T., Poggensee, M., Kodama, Y., *et al.* Rapid translocation frequency analysis in humans decades after exposure to ionizing radiation. *Int. J. Radiat. Biol.*, 62, 53-63.

1992 T. Straume, Lucas J.N., Bigbee W L., Tucker, J.D., Langlois, R.G. Biodosimetry for a radiation worker using multiple assays. *Health Phys.* 62:122-130.

1991 T. Straume, R.G. Langlois, J. Lucas, R.H. Jensen, W.L. Bigbee, A.T. Ramalho, and C.E. Brandão-Mello, "Novel Biodosimetry Methods Applied to Victims of the Goiânia Accident," *Health Phys.* 60, 71–76.

1991 T. Straume, T.C. Kwan, L.S. Goldstein, and R.L. Dobson, "Measurement of Neutron-Induced Genetic Damage in Mouse Immature Oocytes," *Mutat Res.* 248, pp. 123–133.

1991 R.L. Dobson. T. Straume. A.V. Carrano. J.L. Minkler. L.L. Deaven. L.G. Littlefield. and A.A. Awa. "Biological Effectiveness of Neutrons from Hiroshima Bomb Replica: Results of a Collaborative Cytogenetic Study," *Radiat. Res.* **128.** 143–149.

1989 T. Straume. R.L. Dobson. and T.C. Kwan. "Size of Lethality Target in Mouse Immature Oocytes Determined with Accelerated Heavy Ions." *Radiat. Environ. Biophys.* 28. 131–139.

1989 Lucas. J.N.. Tenjin. T., Straume. T., Pinkel. D.. Moore. D. II. Litt. M..and Gray, J.W. Rapid Human Chromosome Aberration Analysis Using Fluorescence In Situ Hybridization. *Int. J. Radiat. Biol.*, 56. 35-44 (1989): 56. 201.

1988 T. Straume and D. Moore. "Shapes of Dose-Response Curves for Human Cancer: New Evidence from A-Bomb Data." *J. Radiol. Prot.* 8. 157–162.

1987 T. Straume. R.L. Dobson. and T.C. Kwan. "Neutron RBEs and the Radiosensitive Target for Mouse Immature Oocyte Killing," *Radiat. Res.* **111.** 47–57.

1986 D. Pinkel. T. Straume. and J.W. Gray, "Cytogenetic Analysis Using Quantitative. High Sensitivity, Flourescence Hybridization." *Proc. Nat. Acad. Sci.* 83. 2934–2938.

CURRICULUM VITAE

Name: **Lynn R. Anspaugh**

Date and Place of Birth: May 25, 1937, Rawlins, Wyoming, U.S.A.

Citizenship: U.S.A.

Address: (office) University of Utah
Division of Radiobiology
Salt Lake City, UT 84112

Education: Nebraska Wesleyan University, Lincoln, NE, 1959, A.B. (Physics);

University of California at Berkeley, 1961 M.Biorad. (Health Physics); University of California at Berkeley, 1963 Ph.D. (Biophysics)

Professional Experience: 1997-Present: Research Professor, University of Utah; 1963-1996: Biophysicist, Lawrence Livermore National Laboratory; 1995-1996: Director, Dose Reconstruction Program; 1993-1995: Director, Risk Sciences Center; 1982-1992: Division Leader, Environmental Sciences Division; 1976-1982: Section Leader for Analysis and Assessment; 1974-1975: Group Leader for Applied Environmental Sciences; 1963-1974: Biomedical and Environmental Sciences; 1961-1963: National Science Foundation Graduate Fellow; 1959-1961: U.S.A.E.C. Special Fellowship in Radiological Physics

Honors: Fellow, Health Physics Society, 1989; Elected Member, National Council on Radiation Protection and Measurements (NCRP), 1989. 1995; Member, U.S. Delegation to the United Nations Scientific Committee on the Effects of Atomic Radiations, 1987-Present

Field of Interest: Radiation dose reconstruction.

Scientific Publications: More than 200 publications. Among them are:

L.R. Anspaugh, J.H. Shinn, P.L. Phelps, and N.C. Kennedy, "Resuspension and Redistribution of Plutonium in Soils," *Health Phys.* **29**, 571–582 (1975).

L.R. Anspaugh, "*In Situ* Methods for Quantifying Specific Radionuclides," *IEEE Trans. Nucl. Sci.* **23**, 1190-1196 (1976).

R.O. Gilbert, D.W. Engel, D.D. Smith, J.H. Shinn, L.R. Anspaugh, and G.R. Eisele, "Transfer of Aged Pu to Cattle Grazing on a Contaminated Environment," *Health Phys.* **54**, 323–335 (1988).

L.R. Anspaugh, R.J. Catlin, and M. Goldman, "The Global Impact of the Chernobyl Reactor Accident," *Science* **242**, 1513–1519 (1988).

R.O. Gilbert, D.W. Engel, and L.R. Anspaugh, "Transfer of Aged $^{239-240}Pu$, ^{238}Pu, ^{241}Am, and ^{137}Cs to Cattle Grazing a Contaminated Area Environment," *Sci. Total Environ.* **85**, 53–62 (1989).

F.A. Mettler, W.K. Sinclair, L. Anspaugh, C. Edington, J.H. Harley, R.C. Ricks, P.B. Selby, E.W. Webster, and H.O. Wyckoff. "The 1986 and 1988 UNSCEAR Reports: Findings and Implications." *Health Phys.* **58**, 241–250 (1990).

L.R. Anspaugh, Y.E. Ricker, S.C. Black, R.F. Grossman, D.L. Wheeler, B.W. Church, and V.E. Quinn. "Historical Estimates of External γ Exposure and Collective External γ Exposure from Testing at the Nevada Test Site. II. Test Series after Hardtrack II, 1958, and Summary." *Health Phys.* **59**, 525–532 (1990).

R.T. Cederwall, Y.E. Ricker, P.L. Cederwall, D.N. Homan, and L.R. Anspaugh, "Ground-Based Air-Sampling Measurements Near the Nevada Test Site after Atmospheric Nuclear Tests." *Health Phys.* **59**, 533–540 (1990).

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CURRICULUM VITAE

Name: **Edwin H. Haskell**

Date and place of birth: November 21st. 1946. Dillon. Montana. U.S.A.

Citizenship: U.S.A.

Address: (office) Center for Applied Dosimetry
University of Utah
825 North. 300 West Suite 107
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WWW http://dax.northgate.utah.edu

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Phone (801) 583-1999

Education:

University of Utah. 1987 M.S.(Instrumentation Physics)
University of California at Santa Cruz. 1978 Ph.D. (Biology)
University of California at Santa Cruz. 1975 M.A.. (Biology).
University of California at Santa Cruz. 1969 A.B. (Biology).

Professional Experience:

1995-Present: Director. Center for Applied Dosimetry, U of Utah
1984-Present: Research Assistant Professor. Radiobiology Division. University of Utah.
1979-1984: Research Instructor. Department of Pharmacology. Radiobiology Division. University of Utah. Head. Thermoluminescence Laboratory.
1969-1972: Lecturer in Biology. South Pacific Regional College of Tropical Agriculture. Apia. Western Samoa (U.S. Peace Corps).

Field of Interest: Radiation dosimetry using environmental materials.

Scientific Publications: The author and co-author of over 35 scientific papers related to radiation dosimetry using solid state techniques on environmental materials in addition to 6 papers currently submitted or accepted for publication:

Sholom. S. [illegible] E. H. Haskell. R. B. Hayes. [illegible] Chumak and G. H. Kenner. Submitted. Influence of crushing and additive irradiation procedures on EPR dosimetry of tooth enamel. Submitted to Radiation Measurements.

Sholom. S. [illegible] E. H. Haskell. R. B. Hayes. [illegible] Chumak and G. H. Kenner. Submitted. The properties of UV light induced EPR signals in enamel and their possible interference with gamma-induced signals. Submitted to Radiation Measurements.

Haskell. E.H.. R. B. Hayes and G. H. Kenner. Submitted. EPR dosimetry of whole teeth using a constant rotation goniometer and standard background subtraction techniques. Submitted to Science.

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Haskell. E. H.. G. H. Kenner. R. B. Hayes. In press. Preparation Induced Errors in EPR Dosimetry of Enamel: Pre and Post Crushing Sensitivity. Appl Radiat. Isot.

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Stonenam. D.. I. K. Bailiff. C. Brodski. G. Hütt. Y. Goksu. E. Haskell. H. Jungner and T. Nagatomo. (1993) TL accident dosimetry measurements on samples from the town of Pripyat. Nucl. Tracks & Radiat. Meas. 21:1. 195-200.

Huntley. D. J.. D.I. Godfrey-Smith and E.H. Haskell. (1991) Light-induced emission spectra from some quartz and feldspars. Nucl. Tracks Radiat. Meas.. Vol 18. N0 1 2. pp 127-131.

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Kaipa P.L. and Haskell E.H. (1985) In situ dosimetry of intact ceramic using the sensitized 210°C TL peak of quartz. Nucl. Tracks and Radiat. Meas., 10 (4-6) 621-623.

Bailiff. I.K., and Haskell. E. H. (1984) The use of the pre-dose technique for environmental dosimetry. Radiation Protection Dosimetry 6. pp 245-248.

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RATE AGREEMENT
COLLEGES AND UNIVERSITIES

UNIVERSITY OF UTAH
PARK BUILDING
SALT LAKE CITY, UT 84112

DATE: November 7, 1994
FILING REF.: The preceding agreement was dated: August 18, 1992 U21103

The rates approved in this Agreement are for use on grants, contracts and other agreements with the Federal Government, subject to the conditions contained in Section II.

SECTION I: RATES

Type	Effective Period From	To	Rate	Location	Applicable To
INDIRECT COST RATES*					
Pred.	07/01/93	06/30/98	49.5%	On-Campus	Organized Research
Pred.	07/01/93	06/30/98	24.0%	Off-Campus	Organized Research
Pred.	07/01/93	06/30/98	34.1%	On-Campus	Sponsored Training
Pred.	07/01/93	06/30/98	26.0%	Off-Campus	Sponsored Training
Pred.	07/01/93	06/30/98	27.5%	On-Campus	Other Sponsored Act.
Pred.	07/01/93	06/30/98	19.4%	Off-Campus	Other Sponsored Act.
Pr[illegible]	07/01/98	06/30/00	Same rates as cited above for 07/01/93-06/30/98		

*BASE: Modified total direct costs, consisting of all salaries and wages, fringe benefits, materials and supplies, services, travel, and subgrants and subcontracts up to the first $25,000 of each subgrant or subcontract (regardless of the period covered by the subgrant or subcontract). Equipment, capital expenditures, charges for patient care and tuition remission, rental costs, scholarships, and fellowships as well as the portion of each subgrant and subcontract in excess of $25,000 shall be excluded from modified total direct costs.

TREATMENT OF PAID ABSENCES
Vacation, holiday, sick leave pay and other paid absences are included in salaries and wages and are charged to Federal projects as part of the normal charge for salaries and wages. Separate charges for the cost of these absences are not made.

TREATMENT OF OTHER FRINGE BENEFITS
This organization uses a fringe benefit rate which is applied to salaries and wages in budgeting fringe benefit cost under project proposals. However, it charges the actual cost of each fringe benefit direct to Federal projects.

SPECIAL REMARKS
The rates in this agreement have been negotiated or revised, as appropriate, to reflect the administrative cap provisions of the revision to OMB Circular A-21 published by the Office of Management and Budget on July 23, 1993. No rate affecting the institution's fiscal periods beginning on or after October 1, 1991 contains total administrative cost components in excess of that 26 percent cap.

SPECIAL REMARKS

The On-Campus rate includes activities conducted at:

1. University of Utah owned facilities.
2. Rental facilities in Research Park.
3. Facilities at Old St. Mark's Hospital.
4. Medical Center also known as the Stangl Building.

The Off-Campus activities are defined as activities not listed above as on-campus or any activity conducted at a field location for a period of longer than 120 days. The distinction between on and off campus activities will be made in accordance with the proposal and based on actual costs incurred at the selected locations (on and off campus).

The 120 days off-campus definition does not apply to welfare training conducted by the University for the State of Utah. On-Campus course preparation and actual off-campus costs of instruction will be separately identified. The on-campus costs of instruction will be separately identified. The on-campus instruction rate will only be applied to the on-campus costs. The off-campus rate should be applied to the off-campus costs exclusive of facility rental costs regardless of who pays these costs.

SECTION II: GENERAL

A. LIMITATIONS: The rates in this Agreement are subject to any statutory administrative limitations and apply to a given grant, contract or other agreement only to the extent that funds are available. Acceptance of the rates is subject to the following conditions: (1) Only costs incurred by the organization were included in its indirect cost pool as finally accepted: such costs are legal obligations of the organization and are allowable under the governing cost principles: (2) The same costs that have been treated as indirect costs are not claimed as direct costs: (3) Similar types of costs have been accorded consistent accounting treatment: and (4) The information provided by the organization which was used to establish the rates is not later found to be materially incomplete or inaccurate.

B. ACCOUNTING CHANGES: If a fixed or predetermined rate is in this Agreement, it is based on the accounting system purported by the organization to be in effect during the Agreement period. Changes to the method of accounting for costs which affect the amount of reimbursement resulting from the use of this Agreement require prior approval of the authorized representative of the cognizant agency. Such changes include, but are not limited to, changes in the charging of a particular type of cost from indirect to direct. Failure to obtain approval may result in cost disallowances.

C. FIXED RATES: If a fixed rate is in this Agreement, it is based on an estimate of the costs for the period covered by the rate. When the actual costs for this period are determined, an adjustment will be made to a rate of a future year(s) to compensate for the difference between the costs used to establish the fixed rate and actual costs.

D. USE BY OTHER FEDERAL AGENCIES: The rates in this Agreement were approved in accordance with the authority in Office of Management and Budget Circular A-122, A-21 or HHS Hospital Cost Principles, as appropriate, and should be applied to grants, contracts and other agreements covered by the appropriate regulation, subject to any limitations in A above. The organization may provide copies of this Agreement to other Federal Agencies to give them early notification of this Agreement.

BY THE ORGANIZATION	BY THE COGNIZANT AGENCY ON BEHALF OF THE FEDERAL GOVERNMENT DEPARTMENT OF HEALTH AND HUMAN SERVICES
University of Utah	
(ORGANIZATION)	(Agency)
Thomas G. Nycum	
(Signature)	(Signature)
Thomas G. Nycum	David S. Low
(Name)	(Name)
Vice President	Director, Division of Cost Allocation
(Title)	(Title)
December 5, 1994	November [illegible] 1994
(Date)	(Date)
NP-CC-H)	HHS Representative Wallace Chan
	Telephone: (415) 556-1704

Hiroshima Neutron Dosimetry
Dr. Tore Straume, Principal Investigator
University of Utah

Project Budget, 1997-1998

PERSONNEL	SALARY	%FTE	FY'1997	%FTE	FY'1998
Straume, Tore (PI)	99,500	0.250	24,875	0.340	35,522
Marchetti, Alfredo	40,000	0.250	10,000	0.340	14,280
TBN (grad)	16,600	0.375	6,225	0.500	8,715
TOTAL SALARY			41,100		58,517
EMP. BENE. (33%)			13,563		19,310
TOTAL SAL&EB			54,663		77,827
Operations					
Travel			7,670		8,054
Purchased Service (AMS)			17,500		18,375
Telephone			1,001		1,051
Maintenance			2,000		2,100
Supplies			17,500		18,375
Total Operations			45,671		47,955
Total Pers & Operations			100,334		125,781
Ind. costs @49.5%			49,665		62,262
Total Pers, Oper, Ind Costs			149,999		188,043
Equipment, computer in 3rd year			0		0
Total including equipment			149,999		188,043

I-129 Dosimetry
Dr. Tore Straume, Principal Investigator
University of Utah

Project Budget, 1997-1998

PERSONNEL	SALARY	%FTE	FY'1997	%FTE	FY'1998
Straume, Tore (PI)	99,500	0.250	24,875	0.330	34,477
Marchetti, Alfredo	40,000	0.250	10,000	0.330	13,860
TBN (grad student)	16,600	0.375	6,225	0.500	8,715
TOTAL SALARY			41,100		57,052
EMP. BENE. (33%)			13,563		18,827
TOTAL SAL&EB			54,663		75,879
Operations					
Travel			9,738		10,225
Purchased Service (AMS)			9,500		9,975
Telephone			400		420
Maintenance			1,000		1,050
Supplies			15,000		15,750
Total Operations			35,638		37,420
Total Pers & Operations			90,301		113,299
Ind. costs @49.5%			44,699		56,083
Total Pers, Oper, Ind Costs			135,000		169,382
Equipment			0		0
Total Including equipment			135,000		169,382

raise
inflation

TL/EPR Dosimetry
Dr. Edwin Haskell, Principal Investigator
University of Utah

Project Budget, 1997-1998

PERSONNEL	SALARY	%FTE	FY1997	%FTE	FY1998	Total
HASKELL E (Scl)	60.730	0.600	36.438	0.800	51.013	87.451
KENNER, G (Scl)	40.544	0.600	24.326	0.800	34.057	58.383
R. Hayes (Grd. S.)	28.481	0.600	17.089	0.800	23.924	41.013
Hancock, A (wk stdy)	3.635	0.500	1.818	0.667	2.545	4.362
Diffey, R. (Tech)	15.058	0.500	7.529	0.667	10.541	18.070
TOTAL SALARY			87.200		122.079	209.279
EMP. BENE. (33%)			28.776		40.286	69.062
TOTAL SAL&EB			115.975		162.365	278.341
						.0
Operations						.0
Travel			8.480		8.904	17.384
Telephone			.200		.210	.410
Maintenance			6.000		6.300	12.300
Supplies			9.812		10.303	20.115
Total Operations			24.492		25.717	50.209
						.0
						.0
Total Pers & Operations			140.467		188.082	328.549
Ind. costs @49.5%			69.531		93.101	162.632
Total Pers. Oper. Ind Costs			209.999		281.183	491.181

Budget Sheet Studies in Russia for the JCCHER
Principal Investigator Lynn R Anspaugh

Project Budget 1997-1999

PERSONNEL	SALARY	%FTE	FY1997	%FTE	FY1998
[illegible]	[illegible]	0.500	60 000	0.670	84 420
[illegible]	[illegible]	0.000	0	0.670	15 477
[illegible] (no longer)	[illegible]	0.000	0	0.670	8 442
	0	0.500	0	0.500	0
			60 000		108 339
TOTAL SALARY			19 800		35 752
EMP. BENE (33%)			79 800		144 091
TOTAL SAL&EB					
Operations			22 000		23 100
Travel			2 250		3 000
Telephone			0		0
Maintenance			7 250		7 613
Supplies			31 500		33 713
Total Operations					
Total Pers. & Operations			111 300		177 804
Ind costs @ 49.5%			55 094		88 013
Total Pers. Oper. Ind Costs			166 394		265 817
Equipment			0		0
Total including equipment			166 394		265 817

Budget Sheet: Economic Research and Risk Analysis
Principal Investigator: Lynn H. Anspaugh

Project Budget, 1997-1999

PERSONNEL	SALARY	%FTE	FY'1997	%FTE	FY'1998
[illegible]	120,000	0.250	30,000	0.330	41,580
Tech	22,000	0.000	0	0.330	7,623
UNL (undergrad)	12,000	0.000	0	0.330	4,158
	0	0.000	0	0.000	0
TOTAL SALARY			30,000		53,361
EMP. BENE (33%)			9,900		17,609
TOTAL SALARY			39,900		70,970
Operations					
Travel			22,000		23,100
Telephone			2,250		3,000
Maintenance			0		0
Supplies			7,250		7,613
Total Operations			31,500		33,713
Total Pers. & Operations			71,400		104,683
Ind costs @ 49.5%			35,343		51,818
Total Pers. Oper. Ind Costs			106,743		156,501
Equipment			0		5,000
Total including equipment			106,743		161,501

UNIVERSITY OF UTAH
INDIRECT COST RATES FOR THE PER...D
JULY 1, 1993 THROUGH JUNE 30, 1998

EXI(
PAGE -

	ORGANIZED RESEARCH			SPONSORED TRAINING			OTHER SPON ACTIVITIES		
		ON-CAMPUS	OFF-CAMPUS		ON-CAMPUS	OFF-CAMPUS		ON-CAMPUS	OFF-CAMPUS
ILDING USE		3.00			0.90			0.70	
QUIPMENT		7.30			2.00			2.80	
PERATION & MAIN		14.00			3.80			3.60	
IBRARY		1.20			1.30			0.90	
EN ADMIN	4.50			5.00			5.00		
EPT ADMIN	17.00			20.00			11.60		
PON PROJ ADMIN	2.50			2.80			2.80		
ADMIN COMPONENTS	24.00	24.00	24.00	27.80	26.00	26.00	19.40	19.40	19.40
OTAL		49.50	24.00		34.10	26.00		27.50	19.40

DMINISTRATIVE COMPONENTS LIMITED TO 26.0% IN ACCORDANCE WITH OMB A-21, DATED JULY 26, 1993)

ONCUR:

Ken Tramm
SIGNATURE)

Director, Cost Accounting
ITLE

12/5/94
DATE

DOE F 4650.2
(10-91)
(All Other Editions Are Obsolete)

Department of Energy
Office of Energy Research (OER)
Face Page

OMB Control No.
1910-1400
(OMB Burden Disclosure Statement on Back)

TITLE OF PROPOSED RESEARCH: Dosimetry studies in support of EH-63 programs

PLEASE TYPE THE FOLLOWING INFORMATION:

1. **CATALOG OF FEDERAL DOMESTIC ASSISTANCE NUMBER:** 81.049

2. **CONGRESSIONAL DISTRICT:**
   Applicant Organ's Dist.: Second Congressional
   Project Site's Dist.: Second Congressional

3. **I.R.S. ENTITY IDENTIFICATION OR SOCIAL SECURITY NUMBER:**
   87-6000525

4. **AREA OF RESEARCH OR ANNOUNCEMENT TITLE/NUMBER**
   Office of International Health Programs

5. **HAS THIS RESEARCH PROPOSAL BEEN SUBMITTED TO ANY OTHER FEDERAL AGENCY?** ☐ yes ☒ no
   PLEASE LIST

6. **DOE/OER PROGRAM STAFF CONTACT (If known)**
   Elizabeth P. White

7. **TYPE OF APPLICATION:** ☒ New ☐ Continuation
   ☐ Supplement ☐ Renewal ☐ Revision

8. **ORGANIZATION TYPE:** Local Government ☐
   State Government ☐ Non-Profit ☐ Hospital ☐
   Indian Tribal Government ☐ Individual ☐ Other ☐
   Institution of Higher Education ☒ For-Profit ☐
   (Small Business ☐ Disadvantaged Business ☐ 8(a) ☐
   Women-owned ☐)

9. **CURRENT DOE AWARD NUMBER (IF APPLICABLE)**

10. **WILL THIS RESEARCH INVOLVE:**
    10A. Human Subjects no ☒ If yes, ☐
    Exemption No. _____ (or)
    IRB Approval Date _____
    Assurance of Compliance No. _____
    10B. Vertebrate Animals no ☒ If yes, ☐
    IACUC Approval Date _____
    Animal Welfare Assurance No. _____

11. **AMOUNT REQUESTED FROM DOE FOR ENTIRE PROJECT PERIOD $** 1,834,079

12. **DURATION OF ENTIRE PROJECT PERIOD**
    1/1/97 (Mo/day/yr.) to 12/31/98 (Mo/day/yr.)

13. **REQUESTED AWARD START DATE**
    1/1/97 (Mo/day/yr)

14. **IS APPLICANT DELINQUENT ON ANY FEDERAL DEBT?**
    ☐ Yes (If "Yes," attach an explanation) ☒ No

15. **PRINCIPAL INVESTIGATOR/PROGRAM DIRECTOR NAME, TITLE, ADDRESS AND PHONE NUMBER**

Scott Miller, Director
Division of Radiobiology
Building 586
University of Utah
Salt Lake City, UT 84112
Ph: 801-581-5638

SIGNATURE OF PRINCIPAL INVESTIGATOR/ PROGRAM DIRECTOR 12/17/96
Date

PI/PD ASSURANCE: I agree to accept responsibility for the scientific conduct of the project and to provide the required progress reports if an award is made as a result of this submission. Willful provision of false information is a criminal offense. (U.S. Code, Title 18, Section 1001)

16. **ORGANIZATION'S NAME, ADDRESS AND CERTIFYING REPRESENTATIVE'S NAME, TITLE AND PHONE NUMBER**

University of Utah
Sponsored Projects
1471 Federal Way
Robert G. Glass
801-581-3008

ATTACHED

SIGNATURE OF ORGANIZATION'S CERTIFYING REPRESENTATIVE _____ 1996
Date

CERTIFICATION & ACCEPTANCE: I certify that the statements herein are true and complete to the best of my knowledge, and accept the obligation to comply with DOE terms and conditions if an award is made as the result of this submission. A willfully false certification is a criminal offense. (U.S. Code, Title 18, Section 1001).

NOTICE FOR HANDLING PROPOSALS

This submission is to be used only for DOE evaluation purposes and this notice shall be affixed to any reproduction or abstract thereof. All Government and non-Government personnel handling this submission shall exercise extreme care to ensure that the information contained herein is not duplicated, used, or disclosed in whole or in part for any purpose other than evaluation without written permission except that if an award is made based on this submission, the terms of the award shall control disclosure and use. This notice does not limit the Government's right to use information contained in the submission if it is obtainable from another source without restriction. This is a Government notice, and shall not itself be construed to impose any liability upon the Government or Government personnel for any disclosure or use of data contained in this submission.

PRIVACY ACT STATEMENT

If applicable, you are requested, in accordance with 5 U.S.C., Sec. 552A, to voluntarily provide your Social Security Number (SSN). However, you will not be denied any right, benefit, or privilege provided by law because of a refusal to disclose your SSN. We request your SSN to aid in accurate identification, referral and review of applications for research/training support and for administrative management of Office of Energy Research grant/contract programs.

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U.S. Department of Energy
Assurance of Compliance
Nondiscrimination in Federally Assisted Programs

OMB Control No.
1910-0400

OMB Burden Disclosure Statement

Public reporting burden for this collection of information is estimated to average 15 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Office of Information Resources Management Policy, Plans, and Oversight, Records Management Division, HR-422 - GTN, Paperwork Reduction Project (1910-0400), U.S. Department of Energy, 1000 Independence Avenue, S.W., Washington, DC 20585; and to the Office of Management and Budget (OMB), Paperwork Reduction Project (1910-0400), Washington, DC 20503.

UNIVERSITY OF UTAH (Hereinafter called the "Applicant")

HEREBY AGREES to comply with Title VI of the Civil Rights Act of 1964 (Pub. L. 88-352), Section 16 of the Federal Energy Administration Act of 1974 (Pub. L. 93-275), Section 401 of the Energy Reorganization Act of 1974 (Pub. L. 93-438), Title IX of the Education Amendments of 1972, as amended, (Pub. L. 92-318, Pub. L. 93-568, and Pub. L. 94-482), Section 504 of the Rehabilitation Act of 1973 (Pub. L. 93-112), the Age Discrimination Act of 1975 (Pub. L. 94-135), Title VIII of the Civil Rights Act of 1968 (Pub. L. 90-284), the Department of Energy Organization Act of 1977 (Pub. L. 95-91), the Energy Conservation and Production Act of 1976, as amended, (Pub. L. 94-385) and Title 10, Code of Federal Regulations, Part 1040. In accordance with the above laws and regulations issued pursuant thereto, the Applicant agrees to assure that no person in the United States shall, on the ground of race, color, national origin, sex, age, or disability, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity in which the Applicant receives Federal assistance from the Department of Energy.

Applicability and Period of Obligation

In the case of any service, financial aid, covered employment, equipment, property, or structure provided, leased, or improved with Federal assistance extended to the Applicant by the Department of Energy, this assurance obligates the Applicant for the period during which Federal assistance is extended. In the case of any transfer of such service, financial aid, equipment, property, or structure, this assurance obligates the transferee for the period during which Federal assistance is extended. If any personal property is so provided, this assurance obligates the Applicant for the period during which it retains ownership or possession of the property. In all other cases, this assurance obligates the Applicant for the period during which the Federal assistance is extended to the Applicant by the Department of Energy.

mployment Practices

Where a primary objective of the Federal assistance is to provide employment or where the Applicant's employment practices affect the delivery of services in programs or activities resulting from Federal assistance extended by the Department, the Applicant agrees not to discriminate on the ground of race, color, national origin, sex, age, or disability, in its employment practices. Such employment practices may include, but are not limited to, recruitment, advertising, hiring, layoff or termination, promotion, demotion, transfer, rates of pay, training and participation in upward mobility programs; or other forms of compensation and use of facilities.

Subrecipient Assurance

The Applicant shall require any individual, organization, or other entity with whom it subcontracts, subgrants, or subleases for the purpose of providing any service, financial aid, equipment, property, or structure to comply with laws and regulations cited above. To this end, the subrecipient shall be required to sign a written assurance form; however, the obligation of both recipient and subrecipient to ensure compliance is not relieved by the collection or submission of written assurance forms.

Data Collection and Access to Records

The Applicant agrees to compile and maintain information pertaining to programs or activities developed as a result of the Applicant's receipt of Federal assistance from the Department of Energy. Such information shall include, but is not limited to the following: (1) the manner in which services are or will be provided and related data necessary for determining whether any persons are or will be denied such services on the basis of prohibited discrimination; (2) the population eligible to be served by race, color, national origin, sex, age and disability; (3) data regarding covered employment including use or planned use of bilingual public contact employees serving beneficiaries of the program where necessary to permit effective participation by beneficiaries unable to speak or understand English; (4) the location of existing or proposed facilities connected with the program and related information adequate for determining whether the location has or will have the effect of unnecessarily denying access to any person on the basis of prohibited discrimination; (5) the present or proposed membership by race, color, national origin, sex, age and disability in any planning or advisory body which is an integral part of the program; and (6) any additional written data determined by the Department of Energy to be relevant to the obligation to assure compliance by recipients with laws cited in the first paragraph of this assurance.

The Applicant agrees to submit requested data to the Department of Energy regarding programs and activities developed by the Applicant from the use of Federal assistance funds extended by the Department of Energy. Facilities of the Applicant (including the physical plants, buildings, or other structures) and all records, books, accounts, and other sources of information pertinent to the Applicant's compliance with the civil rights laws shall be made available for inspection during normal business hours on request of an officer or employee of the Department of Energy specifically authorized to make such inspections. Instructions in this regard will be provided by the Director, Office of Civil Rights, U.S. Department of Energy.

This assurance is given in consideration of and for the purpose of obtaining any and all Federal grants, loans, contracts (excluding procurement contracts), property, discounts or other Federal assistance extended after the date hereof, to the Applicants by the Department of Energy, including installment payments on account after such data of application for Federal assistance which are approved before such date. The Applicant recognizes and agrees that such Federal assistance will be extended in reliance upon the representations and agreements made in this assurance, and that the United States shall have the right to seek judicial enforcement of this assurance. This assurance is binding on the Applicant, the successors, transferees, and assignees, as well as the person(s) whose signatures appear below and who are authorized to sign this assurance on behalf of the Applicant.

Applicant Certification

The Applicant certifies that it has complied, or that, within 90 days of the date of the grant, it will comply with all applicable requirements of 10 C.F.R. § 1040.5 (a copy will be furnished to the Applicant upon written request to DOE).

Designated Responsible Employee

Kaye M. Coleman, Director, OEO & AA
Name and Title (Printed or Typed)

(801) 581-8365
Telephone Number

Signature

Date

Applicant's Name

( )
Telephone Number

Address:

Date

Authorized Official:
President, Chief Executive Officer
or Authorized Designee

Robert G. Glass
Director, Sponsored Projects
Name and Title (Printed or Typed)

(801)581-3003
Telephone Number

ACTING FOR

Signature

Date

CERTIFICATIONS REGARDING LOBBYING; DEBARMENT, SUSPENSION AND OTHER RESPONSIBILITY MATTERS; AND DRUG-FREE WORKPLACE REQUIREMENTS

Applicants should refer to the regulations cited below to determine the certification to which they are required to attest. Applicants should also review the instructions for certification included in the regulations before completing this form. Signature of this form provides for compliance with certification requirements under 34 CFR Part 82, "New Restrictions on Lobbying," and 34 CFR Part 85, "Government-wide Debarment and Suspension (Nonprocurement) and Government-wide Requirements for Drug-Free Workplace (Grants)." The certifications shall be treated as a material representation of fact upon which reliance will be placed when the Department of Energy determines to award the covered transaction, grant, or cooperative agreement.

1. LOBBYING

The undersigned certifies, to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

2. DEBARMENT, SUSPENSION, AND OTHER RESPONSIBILITY MATTERS

(1) The prospective primary participant certifies to the best of its knowledge and belief, that it and its principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;

(b) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (1)(b) of this certification; and

(d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

(2) Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

3. DRUG-FREE WORKPLACE

This certification is required by the Drug-Free Workplace Act of 1988 (Pub. L. 100-690, Title V, Subtitle D) and is implemented through additions to the Debarment and Suspension regulations, published in the Federal Register on January 31, 1989, and May 25, 1990.

ALTERNATE I
(GRANTEES OTHER THAN INDIVIDUALS)

(1) The grantee certifies that it will or will continue to provide a drug-free workplace by:

(a) Publishing a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the grantee's workplace and specifying the actions that will be taken against employees for violation of such prohibition;

(b) Establishing an ongoing drug-free awareness program to inform employees about:

(1) The dangers of drug abuse in the workplace;

(2) The grantee's policy of maintaining a drug-free workplace;

(3) Any available drug counseling, rehabilitation, and employee assistance programs; and

(4) The penalties that may be imposed upon employees for drug abuse violations occurring in the workplace;

(c) Making it a requirement that each employee to be engaged in the performance of the grant be given a copy of the statement required by paragraph (a);

(d) Notifying the employee in the statement required by paragraph (a) that as a condition of employment under the grant, the employee will:

(1) Abide by the terms of the statement; and

(2) Notify the employer in writing of his or her conviction for a violation of a criminal drug statute occurring in the workplace not later than five calendar days after such conviction;

(e) Notifying the agency, in writing, within ten calendar days after receiving notice under subparagraph (d)(2) from an employee or otherwise receiving actual notice of such conviction. Employers of convicted employees must provide notice, including position title, to every grant officer or other designee on whose grant activity the convicted employee was working, unless the Federal agency has designated a central point for the receipt of such notices. Notice shall include the identification number(s) of each affected grant;

(f) Taking one of the following actions, within 30 calendar days of receiving notice under subparagraph (d)(2), with respect to any employee who is so convicted:

(1) Taking appropriate personnel action against such an employee, up to and including termination, consistent with the requirements of the Rehabilitation Act of 1973, as amended; or

(2) Requiring such employee to participate satisfactorily in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or local health, law enforcement, or other appropriate agency;

(g) Making a good faith effort to continue to maintain a drug-free workplace through implementation of paragraphs (a), (b), (c), (d), (e), and (f).

(2) The grantee may insert in the space provided below the site(s) for the performance of work done in connection with the specific grant:

Place of Performance:
(Street address, city, county, state, zip code)

_____

_____

_____

☐ Check if there are workplaces on file that are not identified here.

ALTERNATE II (GRANTEES WHO ARE INDIVIDUALS)

(1) The grantee certifies that, as a condition of the grant, he or she will not engage in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance in conducting any activity with the grant.

(2) If convicted of a criminal drug offense resulting from a violation occurring during the conduct of any grant activity, he or she will report the conviction, in writing, within 10 calendar days of the conviction, to every grant officer or other designee, unless the Federal agency designates a central point for the receipt of such notices. When notice is made to such a central point, it shall include the identification number(s) of each affected grant.

As the duly authorized representative of the applicant, I hereby certify that the applicant will comply with the above certifications.

NAME OF APPLICANT	PR/AWARD NUMBER AND/OR PROJECT NAME
UNIVERSITY OF UTAH	"DOSIMETRY STUDIES IN SUPPORT OF EH-63 PROGRAMS"
PRINTED NAME AND TITLE OF AUTHORIZED REPRESENTATIVE Robert G. Glass Director, Sponsored Projects	
SIGNATURE	DATE

U. S. Department of Health and Human Services

Certification Regarding Lobbying

The undersigned certifies, to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

Award No.	Organizational Entity
"DOSIMETRY STUDIES IN SUPPORT OF EH-63 PROGRAMS"	University of Utah
Name and Title of Official Signing for Organizational Entity	**Telephone No. of Signing Official**
Robert G. Glass, Director Office of Sponsored Projects	(801) 581-3003
Signature of Above Official ACTING FOR	**Date Signed**

3. Retrospective Dosimetry Using Electron Paramagnetic Resonance (EPR) and Thermoluminescence (TL) Techniques in Contaminated Areas of the Former Soviet Union (Principal Investigator: Edwin Haskell)

V) Milestones to be reached (with deliverables),

Collaboration with Dosimetry Efforts of the European Community.

EPR

February, 1997	Ship to GSF custom made goniometer for evaluation
March, 1997	Completion of EPR intercomparison involving methods of analysis.
May, 1997:	Development of protocols for blind intercomparison of teeth by laboratories of the European Community and the FSU.
July, 1997	Irradiation and distribution of intercomparison samples
December, 1997:	Completion of blind EPR intercomparison.

TL

August, 1997	Sample collection in Russia and the Ukraine
Sept, 1997:	Protocols developed for TL analysis of insulators from contaminated regions.
December 1997:	Results of first phase of intercomparison of insulators.
December 1997:	Analysis of results of investigations into light effects on insulators.

Collaboration with Ukrainian Scientific Center for Radiation Medicine (USCRM).

April, 1997:	TL training visit to Utah laboratory
August 1997:	Trip by EH to USCRM for collection of TL samples and analysis of samples in their facility.
November, 1997:	Report on results of intercomparison.

Collaboration with the Urals Research Center for Radiation Medicine (URCRM)

February, 1997	Completion of analysis of TL samples measured in conjunction with GSF in Germany
January, 1997:	Joint paper prepared for publication. Collaborators include University of Utah, GSF and USCRM
May, 1997:	Visit of N. Bougrov to Utah laboratory for measurement of additional samples, discussion of results and assessment of difficulties encountered.
June, 1997:	Measurements of Urals samples completed with dose versus depth profiles obtained.

Collaboration with the Urals Institute of Metal Physics. (UIMP)

March, 1997:	Protocols for a blind intercomparison will be finalized.
May, 1997	Samples distributed, prepared and analyses begun.
June, 1997:	Visit by Dr. Romanyuhka to Utah laboratory for period of 2 months for measurement of teeth obtained from the Urals population.
July, 1997:	Results of the blind intercomparison completed.
August, 1997	Visit by EH to UIMP laboratory. Methods of sample preparation and analysis will be assessed, calibration will be performed and sensitivity and reproducibility of measurements will be tested. Future collaborative arrangements will be determined.

Technical Evaluation of Cost Proposal
University of Utah Cooperative Agreement
January 1, 1997 - September 30, 1997

1. General Areas:

a. Is the Contractor's proposed work statement and schedule compatible with DOE technical requirements?

ANSWER: Yes, the Statement of Work and project details are appropriate.

b. Are there items of work which should be added or deleted? If so, which ones and why?

ANSWER: No, not at this time. Specific milestones and deliverables will be revisited annually.

c. Is there further cost information desired from the Contractor?

ANSWER: No, not at this time.

d. Any pertinent information which would be helpful for Cost Analysis?

ANSWER: Yes, as stated below:

Although EH-63 supports a one-year nine month cooperative agreement, and the University of Utah has provided budget estimates for FY 1998, EH-63 has not performed a technical evaluation of cost proposal on the FY 1998 proposed budget for these activities. We will work with the University in spring and summer of 1997, once we have a clearer idea of our funding capabilities for next fiscal year, to review and approve the proposed FY 1998 budget.

The purchased service (AMS) referred to under Operations Costs on both pages 51 and 52 is Accelerator Mass Spectrometry work to be conducted at LLNL, in Munich, and at Purdue University by the University of Utah Principal Investigator for the Atomic Bomb Dosimetry and Iodine-129 tasks. It is significantly cheaper for DOE to pay a total of $27,000 for the Principal Investigator's use of the LLNL, Munich, and Purdue University equipment than it would be to purchase the equipment (about $500,000).

The activities in Task 5 of the Statement of Work will in no way overlap ongoing thyroid and leukemia studies in Belarus and Ukraine that are currently being funded by EH-63 and managed by the National Cancer Institute.

2. Specific Areas:

Reference or include as appropriate the basis (independent cost estimate, previous or similar procurement data, etc.) on which each of your remarks are based.

a. Labor Hours

i. Does the quantity of labor hours seem reasonable for the proposed effort? What is the rationale to justify this?

ANSWER: Yes, the quantity of labor hours does seem appropriate given the University of Utah's proposed work for this time period. The quantity of labor hours is comparable to what we have supported for this work in previous years. There are five comprehensive tasks, and the University of Utah has proposed just over 5 FTE's to perform the work for this fiscal year.

ii. Does the labor grade mix (design, engineering, analytic, technician, fabrication, etc.) seem appropriate for the proposed effort?

ANSWER: Yes, the combination of a scientist leading each task and some support work on several of the projects has been effective in the past, and we expect it to continue to be effective.

b. Material/Equipment:

i. Does the kind of material/equipment proposed seem appropriate?

ANSWER: Yes, we have had previous agreements of a similar nature before, and the materials/supplies proposed seem very appropriate. Proposed equipment also seems reasonable.

Note 1: The $6,000 maintenance cost on p. 35 is for upkeep of the EPR spectrometer and the TL readers. This cost is significantly less than purchasing new equipment.

Note 2: Most equipment will be University of Utah equipment or DOE-purchased equipment currently located at LLNL. The DOE-purchased equipment at LLNL will be accounted for and transferred to the University of Utah, but will remain property of DOE.

ii. Does the quantity of material seem reasonable?

ANSWER: Yes, it does.

c. Subcontracts:

i. If labor hours and material are detailed, the same information as 2.a and 2.b is required.

ANSWER: No detailed information.

ii. Does the proposed subcontract seem justifiable?

ANSWER: Yes, they do. The proposed subcontracts are with LLNL, a Munich facility, and Purdue University for use of their accelerator mass spectrometry (AMS) equipment. The work on that equipment will still be done by the University of Utah's Principal Investigators, and, as stated above, using other institutions' equipment is much more cost effective in this case than purchasing the equipment (around $500,000), especially as it is anticipated that the two tasks which require the use of this equipment will be completed within 2 years.

d. Travel and Per Diem:

i. Are the number of trips and destinations appropriate?

ANSWER: Yes, they are. The trips proposed are considered to be the minimum necessary to complete the tasks defined in the Statement of Work and the project details.

ii. Are the number of proposed per diem days reasonable?

ANSWER: Yes, they are very reasonable.

Note: It is recognized that per diem and lodging rates fluctuate and that it is acceptable to slightly overestimate costs in order to ensure that the trips can be funded. However, while airfare rates are very reasonable, the per diem and lodging rates are high. It is expected that the actual rates will reflect government per diem and lodging costs

e. Schedule:

i. Does the proposed schedule for performance of work meet Government requirements?

ANSWER: Yes, it does. Proposed work is anticipated to be completed within period of the one year nine-month cooperative agreement, which meets EH-63 requirements and deadlines.

ii. Should the proposed schedule be improved or is it too short?

ANSWER: A more detailed schedule with deliverables and timeframes will be included prior to the award and will clarify that there is no overlap between these studies and other EH-63 funded studies in Belarus and Ukraine.

f. Other Direct Costs:

i. Utilization of computer, publications, overtime, etc.

ANSWER: They look appropriate.

ii. Are these reasonable and justifiable?

ANSWER: Yes, they are.

Justification for Noncompetitive Financial Assistance
University of Utah

A. Sponsoring Program Office: Assistant Secretary for Environment, Safety, and Health, Office of International Health Studies

Awarding Office: Oakland Operations Office

Type of Award Proposed: Cooperative Agreement

Proposed Recipient: University of Utah

B. Nature of Financial Assistance: Cooperative Agreement

Assistance to be Furnished: The U.S. Department of Energy (DOE) will provide approximately $1,800,000 over a one year, nine-month period, to the University of Utah, which will perform various dosimetric and related projects critical to studies being conducted on the effects of radiation on those exposed to the Hiroshima and Nagasaki atomic bombs, the Chernobyl accident, and radioactive contamination from the Mayak facility.

Cost Sharing: Cost sharing is neither required nor contemplated.

Statutory Authority for Proposed Award: Department of Energy Organization Act, Public Law 95-91, as amended.

C. Nature of Application: As a formal solicitation was not issued by DOE, the University of Utah application is considered an unsolicited one.

D. Program Evaluation:

(1) The Overall Merit of the Proposed Project or Activity - The University of Utah's proposed dosimetric and related projects are critical to ongoing epidemiological studies being sponsored by the DOE and conducted on the effects of radiation on those exposed to the Hiroshima and Nagasaki atomic bombs, the Chernobyl accident, and radioactive contamination from the Mayak facility. These projects are expected to result in data and techniques necessary for accurate dose reconstruction of exposed populations, ultimately contributing to new worldwide radiation protection standards.

(2) The Anticipated Objectives to be Achieved and the Probability of Achieving the Stated Objectives - The overall objectives of the projects are to: 1) resolve the neutron discrepancy in the Hiroshima dosimetry system developed in 1986 (DS86); 2) complete a map of iodine dispersion for Belarus that includes both total iodine concentrations in soil and radioiodine deposition densities; 3) establish retrospective dosimetry using electron paramagnetic resonance and thermoluminescence techniques in contaminated areas of the former Soviet Union by collaborating with the European

Community, the Ukrainian Scientific Center for Radiation Medicine, the Urals Research Center for Radiation Medicine, and the Urals Institute of Metal Physics; 4) develop an improved dose reconstruction system for the Mayak workers and the general population, through collaboration with colleagues at institutes in Russia and in the United States; and 5) perform research on methods of dose reconstruction and activities to support dose reconstruction of persons affected by the Chernobyl accident by collaborating with colleagues at institutes in Ukraine, Belarus, and the United States. The University of Utah possesses personnel and resources, as well as an extensive scientific network both in this country and internationally, which will provide for effective conduct of the above activities. Further, the University of Utah application demonstrates an organization of work areas which is flexible enough to be modified as appropriate to reflect experience gained in conducting the proposed effort. On the basis of the foregoing, the probability of achieving the stated objectives is high.

(3) The Facilities or Techniques Which the Applicant Proposes to Make Available to Achieve the Proposed Project Objectives - The University of Utah's facilities and cutting-edge techniques will compliment its highly qualified staff to ensure the proposed projects are achieved. Additionally, the techniques and methods proposed by the principal investigators have been critically reviewed by independent scientific panels supporting DOE and have been judged to be the best currently available.

(4) The Qualifications of the Proposed Project Director or Key Personnel Who are Considered to be Critical to the Achievement of the Proposed Project's Objectives - The University of Utah staff are highly qualified to support the successful completion of this project. All principal investigators assigned to this project are known as leading scientists worldwide in their area(s) of research. They also have each developed comprehensive world-wide networks of scientists, as well as working partnerships with a number of scientists in the countries of the former Soviet Union, Europe, and Japan.

(5) The Appropriateness and Adequacy of the Proposed Budget - The University of Utah has requested a total of about $1,800,000 in DOE funds over a one year, nine-month period. A preliminary review of the proposed budget for the 9-month period, January 1, 1997 - September 30, 1997, has been completed by the technical specialists in the Office of International Health Programs (EH-63); based on this review, the proposed budget was considered appropriate and adequate for that period. A detailed budget review will be performed before the award of the grant.

E. Public Purpose of Support or Stimulation - The health effects of radiation is an issue of concern of the general public. Effective dosimetric studies on the part of principal investigators at the University of Utah will help to resolve the international scientific community's uncertainties about radiation exposure levels and will ultimately help to set new international radiation protection standards.

F. Criteria Relied Upon to Justify Noncompetitive Financial Assistance - The criteria set forth in 10 CFR 600.6 (a)(1) and (a)(4) justify a noncompetitive award to the

University of Utah. The criterion (c)(1) authorizes noncompetitive awards when the activity to be funded is necessary to the satisfactory completion of, or is a continuation of, an activity being funded by DOE and for which competition for support would have a significant adverse effect on continuity or completion of the activity. The principal investigators at the University of Utah are renowned experts in their field and have been supported by the Department of Energy to do this work in recent years. Their collaborations and good working relationships with scientists in the former Soviet Union, the Ukraine, and Belarus are unique and critical to the successful completion of this project, as well as to the successful completion of the scientific studies currently supported by DOE on the effects of radiation on those exposed to the Hiroshima and Nagasaki atomic bombs, the Chernobyl accident, and radioactive contamination from the Mayak facility.

Criterion (c)(4), 10CFR 600.6, authorizes a noncompetitive award when the applicant has exclusive domestic capability to perform the activity successfully, based upon unique equipment, proprietary data, technical expertise, or other such unique qualifications. It has been determined by DOE, in consultation with outside peer review panels, that because of the unique qualifications of the University of Utah's principal investigators, it is the only source that has the comprehensive capabilities to complete these projects.

Based on this information, and the public purpose to be served by the proposed project (see section E above), it is recommended that a noncompetitive cooperative agreement award be made to the University of Utah.

Justification for Noncompetitive Financial Assistance - University of Utah

Project Officer: R. T. Bell — 12/18/96
Tom Bell, Dosimetry Program Manager, EH-63 — Date

Office Director: Frank Hawkins — 12/18/96
Frank Hawkins, Director, International Health Studies, EH-63 — Date

Senior Program Official: for Andy Jarmon — 12/23/96
Paul Seligman, Deputy Assistant Secretary for Health Studies, EH-6 — Date

Office of General Counsel: _____ — _____
Date

Contracting Officer: _____ — _____
Date

STATEMENT OF SUBSTANTIAL INVOLVEMENT

The U.S. Department of Energy (DOE) and the University of Utah hereby enter into a 1-year, 9-month cooperative agreement for the purpose of completing various dosimetric and related projects critical to studies being conducted on the effects of radiation on those exposed to the Hiroshima and Nagasaki atomic bombs, the Chernobyl accident, and radioactive contamination from the Mayak facility.

Substantial involvement is anticipated between DOE and the University of Utah during the performance of the cooperative agreement due to the expectation that DOE will share in the responsibility for overall direction of the project. Also, DOE will maintain the right to intervene in the conduct or performance of the project activities for programmatic reasons.

DOE ROLES AND RESPONSIBILITIES

DOE will provide general programmatic direction and oversight of the project. DOE will be responsible for providing all pertinent information (non-classified) which is requested by University of Utah in the development of informational materials and/or other products. DOE will also be responsible for providing appropriate liaison personnel to work with the University of Utah personnel in meeting specific goals identified by the two parties. DOE will receive semi-annual progress reports related to the accomplishment of project activities.

UNIVERSITY OF UTAH ROLES AND RESPONSIBILITIES

The University of Utah is responsible for the overall management and scientific research and will ensure timely and professional execution of related activities, as specified in the Statement of Work, and for coordination of the effort in accordance with DOE, EH-63, and Oakland Operations Office Contracting Officer reporting requirements. The University of Utah shall provide all personnel, facilities, equipment, supplies, and services and otherwise complete all activities set forth in the Statement of Work.

The substantial involvement by DOE under this cooperative agreement will remain for the term of the cooperative agreement award unless otherwise amended. This statement of substantial involvement by DOE does not increase DOE's liability under the cooperative agreement award.

JUSTIFICATION FOR USE OF A COOPERATIVE AGREEMENT

The Department of Energy, under the Office of Environment, Safety, and Health, as funding agency for support for the University of Utah, will work with the University of Utah to determine reasonable project objectives, milestones, and completion dates, and will provide financial support and ensure that the objectives are diligently pursued.

The statutory authority for the use of a cooperative agreement is the Atomic Energy Act of 1946 and 1954, as amended, and Public Law 97-258 of September 13, 1982.